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ABSTRACT

This study uses as data parts of the material gathered within the Curriculum Diffusion Research Project, a British project which examined the diffusion of new science curricula. The concept and context of curriculum diffusion as a new field of enquiry in Great Britain is discussed, together with the problems associated with its study; special attention is directed toward the status and acceptability of the case-study method of enquiry in educational research. Various indicators are examined to discuss the influence of curriculum development projects in science, and entries to the Nuffield O level examinations are used to discuss the full use of the projects. (Author/MH)

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# COMMUNICATION AND SUPPORT FOR CHANGE IN SCHOOL SCIENCE EDUCATION

J.HARDING

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# COMMUNICATION AND SUPPORT FOR CHANGE IN SCHOOL SCIENCE EDUCATION

Joyce M. M. Harding

Centre for Science Education, Chelsea College,
University of London

1975

# ABSTRACT

This thesis uses as data parts of the material gathered within the Curriculum Diffusion Research Project, directed by Professor P.J. Kelly and based at the Centre for Science Education, Chelsea College, University of London (1971-74). This project examined the diffusion of new science curricula.

In the first part of the thesis the concept and context of curriculum diffusion as a new field of enquiry in this country is discussed, together with the problems associated with its study; special attention is directed towards the status and acceptability of the case-study method of enquiry in educational research.

Within Part II of the thesis various indicators are examined, to discuss the influence of curriculum development projects in science. Entries to the special Nuffield O-level examinations are used to discuss the full use of projects in terms of candidates, schools and LEAs as adopting units.

The concept of a local communication-support system, including the LEA and other local institutions, as the context within which maintained schools operate and which partially determines the nature of the science education they offer is developed in Part III. An attempt to quantify communication-support for a sample of LEAs and to relate it to the use of projects was unsuccessful as insufficient data were available.

In Part IV the communication activities of science teachers in four LEA areas are charted and shown to be institutionalized by formal structures, the local nature of which is dependent on the presence of key persons. A typology of stances that teachers assume towards curriculum projects is proposed. It is suggested that these, together with certain personal characteristics of teachers, influence the outcomes of decision-making, carried out by a process of matching the perceived demands of a curriculum project with the teacher's world, along dimensions of dissatisfaction, acceptability, relevance and feasibility.

## ACKNOWLEDGEMENTS

Many people have been involved in the working through of this study and without them it would not have been completed. I, first, must thank Professor P. J. Kelly, the director of the Curriculum Diffusion Research Project, who made it possible for me to use the work I undertook for the project as the basis of this thesis and in whose constant interest and support I have found much encouragement.

My thanks go to the research group for early discussions and criticisms: to Edgar Jenkins, Dennis Marshall, Bill Sheridan and, especially, to Robert Nicodemus and Mary Waring.

In the field-work I met with unfailing courtesy: from the LEAs, hard-pressed in 1973, and from the science teachers in the schools I visited, who gave readily of their time and interest, to make that period of the work one of the most enjoyable for me. I am especially grateful to those science advisers (within the study and so not mentioned by name) who so cheerfully took on the added burden of the "time and motion study" and to Jim Ritchie and Chris Elliot for never failing to scrutinize and comment on draft documents I sent to them for criticism.

I wish to express my gratitude to Isobel Provan for the help she has given me in assembling, checking and presenting data and for typing the bulk of the materials. Linda Strachan has kindly completed the typing.

The discussions and conclusions remain my own.

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# COMMUNICATION AND SUPPORT FOR CHANGE IN SCHOOL SCIENCE EDUCATION

## PART I CONTEXT AND METHODOLOGY

## CHAPTER I

## CURRICULUM DIFFUSION IN CONTEXT

### Introduction

The interpretation of science and the role it plays in education has been problematical for more than a century. Various studies (Kelly, 1971; Harding, 1971; Layton, 1974; Waring, 1975) have commented on the part played by key persons and institutions in attempts to bring about change in science education in this country.

The 1960s saw the introduction of a new strategy for curriculum change: the national curriculum development project. Waring (1975) has discussed the interaction of concern, events and responses that led to the establishing of the Nuffield Science Teaching Projects.[1] With the founding of the Schools Council in 1964[2] curriculum development in England and Wales had become institutionalised.

The study presented in this thesis focusses on the infrastructure and processes that intervene between a project in its developed form and its use in schools. Within the literature this stage of the innovation process has been identified as "diffusion", or the "innovation-decision process".

### The importance of diffusion

Kelly (1970) commented that "over time emphasis has been put on the successive stages of curriculum innovation one by one". These stages were identified as initiation, development, diffusion and implementation.

Following the call for curriculum renewal (initiation), early discussion centred around an ideal curriculum process containing the elements of aims and objectives, learning activities, knowledge content and evaluation (Wheeler, 1967, and Kerr, 1968). The process was "ideal" in the sense that it was not linked to institutional or organisational factors and was potentially applicable to the activities of a teacher in the school situation, to the administrator with curricular responsibilities, or to the deliberations of a curriculum development project team (i.e. to the development stage of curriculum innovation).

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1. Although the Nuffield Science Teaching Project was referred to initially as a singular project, each of the curricula developed within it came to be known as a "project" in its own right.
2. See discussion in Chapter 9 on the establishing of the Schools Council

These elements of the curriculum process may be detected in the early Nuffield project (Waring 1975), with somewhat variable emphases: evaluation, for example, was limited to the feedback from trial school teachers. Later, Schools Council projects included the role of the evaluator, but the nature of the evaluation employed has evolved rather than been applied from any theoretical model, although discussion of conceptual models of evaluation and its appropriate methodology has followed (MacDonald, 1971 and White, 1971).

When attention shifted to the use made of the developed projects in the schools the apparent lack of influence of some national projects was a cause for concern (e.g. Wastnedge, 1971). The pragmatic response to this concern varied. For those accepting the role of the centrally developed project more stringent formative evaluation was required, or more effective dissemination. Within the latter emphasis the Curriculum Diffusion Research Project received support from the S.S.R.C[1] and the Schools Council set up a "Dissemination Working Party". Ralphs(1972) claimed that the setting up of the latter

> "represents the Council's acceptance of the need to rethink completely the whole question of how to communicate the results of project work effectively, given the large amount of such work being undertaken".

He identified the need to determine and strengthen communication networks for teachers and to pinpoint "how decision to adopt projects come to be made". Meanwhile, the Curriculum Diffusion Research Project had identified as part of its objectives the two processes of communication and decision-making.

There were some, however, who questioned the validity of the national project and recommended return to the "grass-roots" development by local teachers to ensure the level of commitment from them that would lead to effective implementation.

That this was not confined to England is illustrated by Connelly's (1972) comments from across the Atlantic.

> "There is widespread feeling that the recent period of centralised curriculum development has not amounted to much, at least not as much in terms of instructional change and learner outcomes as was expected. One of the responses to this feeling..... has been to decentralize curriculum development to the point of making it a local school activity. The first entrenches an inadequate view of curriculum development that tends to treat teachers as mere transmitters of ideas, while the second replaces this

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1. The project was based at the Centre for Science Education, Chelsea College and directed by Prof. P. J. Kelly.

> view with one that is equally inadequate in that it tends to treat teachers as the initiators of ideas and materials. These two responses continue oscillations that have been in existence since at least the turn of the century"

The strand of local curriculum development had always run alongside and interacted with that of the centrally developed project in this country. Indeed, the mode of the Nuffield Junior Science Project had been that of local groups exploring what could be achieved in schools. This work was reported in the form of descriptive case studies[1], but its impact was minimal elsewhere in the system: grass-roots development does not eliminate the problem of dissemination, if valuable and viable practice is to be other than merely parochial.

It was apparent, also, that the problem of successful implementation of an innovation (whatever that might mean in terms of the number of adopting units and the correspondence between trial/development and practice) was not merely one of dissemination. MacDonald and Rudduck (1971) identified "barriers to success", Gross et al (1971) highlighted organisational and other factors leading to the "failure" of an innovation. Attention has been directed to the "infrastructure" between projects and the classroom. Exhortations to change were replaced by "strategies for change" (Owen 1968) and evaluation was extended to include the social system as well as the development of the project.

Studies and discussions within the English setting have begun to accumulate since the end of the nineteen sixties.

## The literature of curriculum diffusion

The concept of the diffusion of curriculum change is relatively new and the specific literature is limited. The works of Alice Miel (1946), Ralph Tyler (1950) and Hilda Taba (1962), in the United States, have been quoted as formative in the curriculum development movement in surveys such as Goodlad (1968), Kelly (1970), Mackenzie (1970) and Taylor (1970), but they focus essentially on the development stage of change.

Nicodemus (1971) has prepared an annotated bibliography that places emphasis on science education, drawing on both studies in educational change and on diffusion research in general.[2]

One of the most useful collections of case-study in innovation in education (but, again, from the U.S.) appears in Miles (1964). In addition, it includes a series of papers reviewing research findings

> "to make generalizable sense of data collected.....and to develop regularized means of studying innovative processes in educational systems"

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1. Nuffield Junior Science Project, Teachers Guide 2. Collins 1967.
2. Many of the publications referred to in the following discussion may be found in this bibliography.

In one of these papers Mort reviews several decades of his work on diffusion lag and its correlates in school and community settings. The wealth of a community and the financial provision for the school system emerge as important accelerators of adaptation to change, but Mort finds that the pace of diffusion is slow and assumes it must be so:

> "......it would appear that knowledge of the slowness of spread of an innovation - among the teachers in a school, among the schools in a school system, and from school system to school system - is essential. Lack of such knowledge has resulted in the abandonment of many good innovations before they had a chance to put down their roots".

Carlson (1964), however, demonstrates that the social status of the superintendent is an important determinant of the use of modern math in his school system, while Mackenzie (1964) focusses on the unintended consequences of the introduction of some innovations, as when attempts to raise standards resulted in increased failure and rate of drop-out among students, or attempts to redeploy staff led to the lowering of morale.

Rogers (1971) uses a cross-cultural approach in drawing upon several research traditions, including education, in the diffusion of innovations. In all, he has consulted some 1,500 publications in applying a "middle-range analysis" to relate theory to research. The outcome is 103 statements connecting pairs of concepts in diffusion research. While this may eventually lead to inductive theory-building, Rogers recognises that

> "our generalisations deal almost entirely with pairs of concepts, whereas the real nature of diffusion is certainly an inter-relationship among numerous variables"

As most of these studies were from rural sociology and relatively few were from education, care must be taken in applying generalisations to curriculum diffusion.

In attempting to relate independent variables to levels of adoption of new science curricula, Nicodemus (1973) found that hypotheses derived from the literature failed to discriminate. His studies demonstrate "that the adoption of an innovation as complex as an O level curriculum or an A level scheme requires more variables than were originally considered". He derives 135 statements relating adoption to independent variables, but again no attempt is made to establish inter-relationships.

## The dimensions of diffusion

Diffusion has been conceptualised as a stage in an educational change process, categorized first by Brickell (1961) as "Research", "Development" and "Diffusion". He commented "our failure to distinguish - indeed, our dogged refusal to recognise - the three phases of change is the most formidable block to instructional improvement today".

The categories were later subdivided by Clark and Guba (1965) and extended to include an "Adoption" stage. Others have followed this pattern and Mackenzie (1970) has proposed that "Development" includes Invention, Design and Evaluation, "Diffusion" includes Dissemination and Demonstration, "Adoption" includes Trial, Decision, Installation and Institutionalisation.

These appear to be stages that are visible from the central position of a national curriculum project or of a district administrator wishing to implement a specific change.

For Rogers (1971) "diffusion is a special type of communication", being the process whereby innovations spread, whereas "communication studies encompass all types of messages". He defines diffusion as "the communication through certain channels of an innovation over time among members of a social system", and refers to it as "the adoption process", or, more recently, as the innovation-decision process.

This process is further conceptualized into four stages: knowledge, persuasion, decision and confirmation (these replace the earlier stages of awareness, interest, evaluation, trial and adoption-decision).

When evidence for the existence of stages is discussed he concludes that it is most clear-cut for the knowledge and decision functions, somewhat less so for the persuasion function, while poor data exists for the confirmation function. Moreover, at times, where stages are identifyable, their order may not be constant. Rogers' stages of diffusion appear to focus on the client system and cover the Diffusion and Adoption stages above.

While others (e.g. Lionberger 1970) also conceptualise an adoption process, Kelly (1970) prefers to identify adoption as the interface between diffusion and implementation. The latter perspective implies a decision to adopt or reject an innovation at an identifyable moment in time, while the former allows for oscillations in decision as the stages develop. It may be that for an individual a decision to adopt or reject most often crystallizes at a moment in time, at some point in the diffusion process, but when an innovation is the focus of attention it is more useful to conceive of a process, with clients making decisions at different stages along it.

## Time as the base-line for the adoption or diffusion process

To identify diffusion of innovation as an adoption process directs attention to the mechanism, or "how", of the process, and deflects it from the rate and direction of diffusion.

Rogers (1971) quotes Kats (and others) as stating "time is the key to diffusion research". Certainly many studies examine diffusion at a moment in time in terms of the adoption and non-adoption of an innovation, and over time by the rate of adoption, categorising "innovators", "early adopters", "late adopters" and "laggards" in terms of the time interval from the launching of an innovation to its adoption. An S-shaped cumulative adoption/time curve is frequently demonstrated and its characteristics used to derive the adopter categories.

But time, as the continuum against which criteria for categorising adoption are determined, is valid only if the variables influencing behaviour are continuous for all adopting units and differ only in degree. Then one can use the concepts (for example) of "cosmopoliteness" and "traditional/modern" to examine correlation between measures of these and early/late adoption.

If variables are discontinuous, for example if schools are comprehensive modern, grammar, mixed or single sex (and changing), or if LEAs are counties or boroughs, then comparisons against a single time continuum has limited success in describing the adoption behaviour in any individual case. Rogers recognises this in briefly examining collective and authority decisions. He states

> "by ignoring within system decision-making, past enquiry distorted the reality of how many innovation choices are actually made. And we have not studied change in a structural context that could likely contribute to theoretical understanding"

Alternative models for dissemination: strategies for change

Following a three-year review of literature undertaken "to find out what scholars, researchers and practitioners had to say about dissemination and utilisation" of knowledge, Havelock(1971) identifies three models in current use.

The first, R, D and D, is a form of the Guba and Clark model: basic research, applied research, development and testing of prototypes, mass production and packaging and planned dissemination activities directed at the user. It assumes a rational sequence, planned over time, with a careful division and co-ordination of labour, involving high costs. These are, however, acceptable, as quality and efficiency of the product are to be assured for its mass dissemination to a rational, but passive, user.

The second is a social interaction model emphasising the patterns by which innovations diffuse through a social system. It assumes that group membership, the adopter's place in it and his identification with its norms and values are important determiners of adoption.

The third is identified as a problem-solving model in which search and retrieval are used to solve a problem that has been diagnosed and formulated within the client system; any change agent is non-directive and the self-initiated commitment to innovation is strong.

Havelock recommends a synthesis of all three models leading to the establishing of regional "Resource-Linking Agencies" making two-way links between the user system and potential resources.

Bennis, Benne and Chin (1969) have identified three major strategies for innovation in current use:

1. empirical-rational strategies;
2. normative-re-educative strategies;
3. power-coercive strategies.

These have assumed some authority in that CERI[1] (1973) have used them as a framework within which to analyse and discuss educational innovation.

Sieber (1972) uses varying images of the practitioner to analyse current debate and identifies the three strategies in use as directed towards a "Rational Man", a "Cooperator" and a "Powerless Functionary". He points out the advantages and short-comings of each in terms of effort, coverage and yield and, again, proposes an alternative strategy "that seeks to combine the key insights of each image".

Much of the evidence and debate used as data in these analyses originated in North America, where others, too, have made recommendations. Lawler (1970) has edited a series of papers in which there is much discussion of strategies for change, some directed primarily at the administrative system, others focussing on the classroom. Goodlad (1964 and 1968) has, for some years, advocated a three-level analysis within strategies for change, examining societal, institutional and instructional factors. This has the virtue of recognising the complexity of decision-making in effecting change.

In this country Owen(1963), speaking from an administrative position, sees the role of strategy that of facilitating partnership between innovators and users

> "in an attempt to elicit the full potential of each party, recourse must be made to bargaining, to mutual accommodation and to the avoidance of mutually damaging behaviour"

When innovation meets with resistance

> "the causes are connected with concern for status, with fear, with indifference and with much else that has to do with the general make-up of human beings and of organisations"

## The inadequacy of theoretical models

There has been a growing sense, particularly in America, that, in common with centrally-developed curriculum projects, theoretical models have been relatively ineffectual in bringing about desirable changes in education.

The curriculum field is complex and we still have very inadequate maps to show how its parts are related, but yet are obliged to make on-going decisions at all levels.

Schwab(1969), in the U.S., remonstrated that

> "the field of curriculum is moribund, unable by its present methods and principles to continue its work".

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1. Centre for Educational Research and Innovation. OECD.

It became this way

> "...... through inveterate and unexamined reliance on theory in an area where theory is partly inappropriate in the first place and where the theories extant, even where appropriate, are inadequate to the tasks which the curriculum field sets them"

He recommends a channelling of energies to the practical and eclectic where by practical he means

> "the discipline concerned with choice and action in contrast with the theoretic, which is concerned with knowledge"

and where the eclectic arts enable

> "......an unsystematic, uneasy but usable focus on a body of problems among diverse theories, each relevant to the problem in a different way".

Taylor (1970), in this country, pointing to undesirable effects of theoretical models of curriculum process recommends "frequent trips to the real world". He set out to determine "how teachers plan their courses" and, using multivariant analysis of a carefully developed questionnaire, derived a model for curricular decision-making. However, as the teachers in his sample, at the time of the enquiry, made very little use of curriculum development materials and other outside agencies (apart from public examinations) his model is of little help to those concerned with curriculum development.

Hoyle (1969) and Kelly (1970) have outlined primitive maps to guide explorations into the curriculum field and some descriptions of expeditions are forthcoming. Hoyle has initiated a study of the role of the LEA adviser in innovation; useful information is available in reports of the development stage of the Humanities Curriculum Project (MacDonald and Rudduck, 1971; Humble and Rudduck, 1971; Stenhouse, 1974) and of the Keele Integrated Studies Project (Shipman, 1974), but few descriptions of post-development diffusion exist.

In 1971 Kelly proposed to study the diffusion of the Nuffield Science Teaching Projects. Intensive curriculum development in science had been proceeding for more than a decade; much datum on its diffusion was there for the collecting. It seemed an irreparable loss to allow it to disappear.

## CHAPTER 2

## THE CURRICULUM DIFFUSION RESEARCH PROJECT AS THE CONTEXT OF THIS STUDY

The Curriculum Diffusion Research Project (CDRP) was initiated at the Centre for Science Education, Chelsea College, London University by Professor P. J. Kelly. Its antecedents were a pilot study of the diffusion of the Nuffield A level Biological Sciences Project, carried out by Kelly and Nicodemus (1973), and the systematic accumulation by Kelly of data on entries to the special Nuffield examinations from the G.C.E. Examination Boards.

Support for the project was obtained from the Social Science Research Council in 1971. The proposal showed an intention to use questionnaire surveys, interview surveys and case studies for the collection of data, over a three year programme.

As few studies of diffusion in education in Britain were extant at the time,[1] it was decided that the project would be largely exploratory, directed towards identifying factors operating in the diffusion and adoption of new curricula and the identification and description of possible processes involved.

### Personnel associated with the project

A Consultative Committee was set up to advise on the selection of samples and the nature of the questions that were to direct the enquiry.

A small research group of persons, who were interested in the enquiry and prepared to contribute to it, was formed and two full-time research fellows were appointed, one for the full three years of the project and the other for the last two years.[2]

### Data-sources

Figure 2.1 shows the data sources that were used by the project and indicates how the enquiry was structured.

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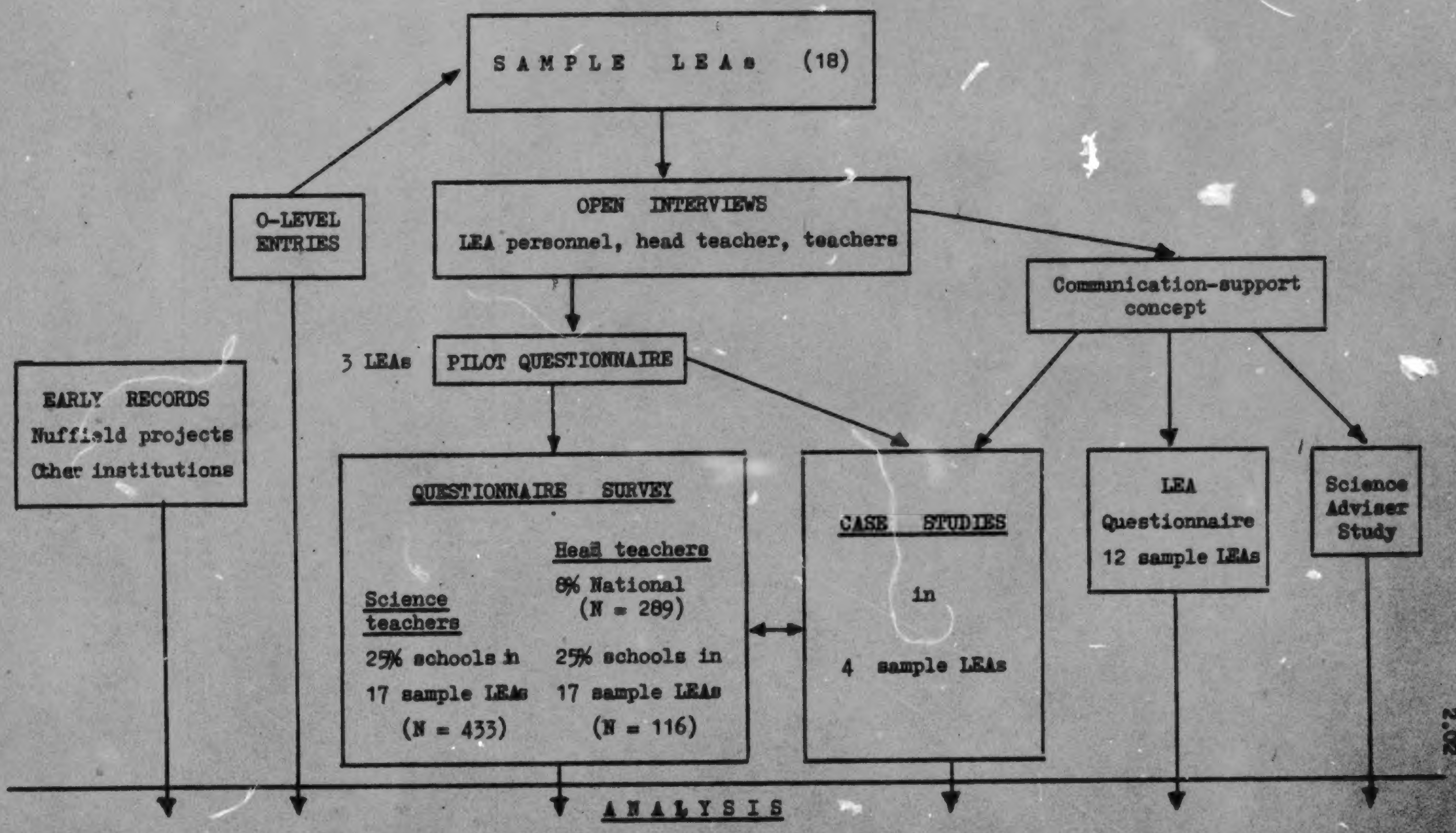
1. The pilot study referred to above, the account by Jenkins (1971) of the use of Nuffield O level Chemistry and the surveys by Thorpe and the Schools Council, discussed in Chapter 4, appeared to be the only studies relevant to diffusion, apart from some aspects of the development of certain projects mentioned in Chapter 1.
2. The present writer was a member of the research group in the first year and became the research fellow appointed for the last two years of the project.

## CURRICULUM DIFFUSION RESEARCH PROJECT - DATA SOURCES


SAMPLE LEAs (18)
O-LEVEL ENTRIES
OPEN INTERVIEWS
LEA personnel, head teacher, teachers
Communication-support concept
3 LEAs
PILOT QUESTIONNAIRE
EARLY RECORDS
Nuffield projects
Other institutions
QUESTIONNAIRE SURVEY
Science teachers
25% schools in 17 sample LEAs (N = 433)
Head teachers
8% National (N = 289)
25% schools in 17 sample LEAs (N = 116)
CASE STUDIES
in
4 sample LEAs
LEA
Questionnaire
12 sample LEAs
Science Adviser Study
ANALYSIS

## The choice of samples

From the beginning the autonomy and individual nature of the local education authority (LEA) was recognised: The only data on the use of new curricula readily available were the O level entries from 1966-71; from these it was apparent that some LEAs provided fertile ground for the full use of projects, while others did not. The LEAs in England and Wales were therefore categorized into high adopters (when they had four or more schools entering candidates for the examinations in 1970)) and non-adopters (when they had no schools using projects to examination in 1970). An attempt was made to select representative, matched pairs of LEAs, in terms of size and type of authority, from the two groups, but this proved to be impossible, as no two LEAs in England and Wales were alike. However, after much discussion within the Consultative Committee and the research group, a list of 18 LEAs, nine "high adopters" and nine non-adopters, was accepted as forming a representative sample of LEAs.

## The open interviews

All eighteen LEAs agreed to participate in the enquiry and during the first year visits were arranged to each authority, in which many aspects of curriculum development were discussed. A check-list of questions[1] was used, but the interviews were not otherwise structured in anyway. The full-time research fellow was present as recorder at each interview, together with a member of the research group,[2] who had local knowledge of the area visited and who took the lead in initiating discussion.

The LEA personnel participating in these interviews varied in number, but usually included an assistant education officer with schools' responsibility or an adviser/inspector whose appointment subsumed responsibility for science in the secondary schools.

In addition to these interviews at the LEA level it was possible for some of the research group to visit schools within the sample LEAs in their own local areas[3] to discuss, again in a relatively unstructured way, the problems of curriculum development and response with head teachers and heads of science departments.

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1. See Appendix Q(i).
2. The present writer took part in the interviews for two LEAs in this capacity.
3. The present writer interviewed headteachers and heads of science in 9 schools in two LEAs.

The reports of both these sets of interviews were written up and made available to members of the research group. They formed the basis of much of the work that developed in the CDRP.

The questionnaire studies

A questionnaire was formulated, covering many aspects of the adoption of projects: sources of information, limiting and facilitating factors, the perceived effects of projects and how decisions had been made about their use. This was circulated to all headteachers and science teachers within two LEAs and within 10% of the schools in a larger authority and visits were made to a few schools in two of the areas[1] to discuss with teachers the problems they faced in completing the questionnaires.

During the summer of 1972 the problems of computer analysis of the pilot questionnaire were explored and, in the autumn, when the present writer was seconded to the project on a full-time basis, work was begun on the design of the final questionnaire.

The pilot study had shown that it was inappropriate to submit the same questionnaire to headteachers and science teachers, so that different forms were prepared for the two groups.[2] It was apparent, also, that changes in staff, and the distance in time from events, made the probing of decision-making over time by questionnaire impossible to carry out with any reliability. Consequently, the exploration of the decision-making process was placed in the case-study programme, together with a study of the communication process.

Further, there was concern about the non-random nature of the sample of LEAs and, as a separate, more general, questionnaire was being designed for headteachers, it was decided to administer this to the headteachers of a national sample of maintained schools. An 8% stratified random sample of schools was compiled for the project by the Department of Education and Science for this purpose. In the winter of 1972/3 the appropriate questionnaire was sent to the headteachers and all science teachers in a 25% random sample of schools in the 17 LEAs remaining in the study.

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[1] The present writer visited two schools in one area.
[2] See Appendices P(i) and P(ii)

Division of labour

Towards the end of 1972 a decision was made to allocate responsibility for different parts of the study to individuals in the research group, for, up to then, all members had participated in the work as it had developed, except that one full-time researcher alone had been involved with the computer. He continued to handle this side of the analysis, while the present writer assumed responsibility for the case-studies and for the completion of the work begun earlier on the analysis of examination entries.

The latter is reported in Chapters 5-7 of this study and explores pupils, schools and LEAs, separately, as adopting units for the three Nuffield O level projects.

In addition, the data available from publishers, early investigations of the use of projects, records of in-service courses and what remained of the Nuffield projects' early records, were studied and form the basis of discussions in Chapters 4 and 8.

The Communication-Support System

The communication-support system, as a concept, emerged from the requirements of the case-study programme: the need for some rational basis on which to make decisions about locations for the studies, coupled with the information already available from the open interviews within LEAs. The concept is elaborated in Chapter 11.

Following its acceptance by the research group as a useful organising concept, several developments followed:

1. Statements about the elements of the system were included in sections of the questionnaire. (The responses to these were used to assess the validity of the communication-support system in Chapter 14 of this study.)
2. Hypotheses were generated relating communication and support with use of projects.[1]
3. The choice of case-study locations[2] was made in terms of the provisional ranking of LEAs on the elements of the communication-support system.
4. In order to obtain more complete data for the communication-support system than the open interviews provided, a questionnaire[3] was sent to all LEAs in the sample. The responses were analysed initially by an LEA adviser who was a member of the research group and are discussed in Chapter 12.

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[1] See discussion in Chapter 11

[2] See Appendix S(i) B

[3] See Appendix Q(ii)

## The Science Adviser Study

The part played by science advisers in the communication-support system was one of great potential importance, yet few descriptions of their role existed. To obtain teachers' and administrators' views of the importance of various role statements for advisers, a list of such statements was included in the teachers' and LEA questionnaires. Little discrimination between roles was obtained from responses so that a further study of how their time was actually spent was initiated with four advisers, to extend for a period of six months. The results of these enquiries are discussed in Chapter 13.

## The Case-Studies

During the calendar year 1973 the writer visited 31 schools in four LEAs, interviewing 105 science teachers. (In one week of visits she was accompanied by the other full-time research fellow who interviewed a further 7 teachers in three schools.) Although no formal interviews were planned with head teachers, in many cases it was possible to talk informally with the head of a school during the course of a visit. Other institutions and persons, mentioned by teachers as influential in science education, were visited, whenever possible, while the writer was in each area.

The objectives formulated for the case-studies were to enquire into teachers' perceptions of certain projects[1], and into the processes of communication[2] and decision-making. The data collected are reported fully in Appendix S and discussed in Part IV of this study.

## The use of the teacher and headteacher questionnaire responses in this study

The writer had access to the frequency counts and means[3] of the responses obtained in the questionnaire enquiries. Reference has been made to these in the discussions whenever they were relevant to the matter discussed.

The methodologies employed in the project are discussed in the following chapter.

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[1] See Appendix R(iii) for schedule used.
[2] See Appendix R(iv) for schedule used.
[3] See Appendices P(iii), (iv) and (v).

# CHAPTER 3

# SOME METHODOLOGICAL PROBLEMS

## The acceptability of research methods

Hägerstrand (1967), one of the early pioneers of diffusion studies, insisted that data used in these studies must be complete and available over time. Where systematic records of relevant data exist, these are invaluable. In elegant studies of spatial diffusion of social elements, such as the possession of radios and motor cars, in Norway, Hägerstrand had access to complete records of licences purchased in local offices. Whitehand (1970) used university examination papers to study the diffusion of "new" geography, while Coleman et al (1966) drew upon the centrally preserved prescriptions, written by doctors, to validate their reported use of a new drug.

But the use of few innovations is systematically recorded and diffusion researchers must seek information by questionnaire, interview and case study.

Rogers (1964) has discussed the main diffusion research traditions and suggests that they show differences in the methods of data gathering and analysis.

The data collecting methods listed in Table 3.1 are those generally available in sociological research and in much of educational research that is not of a purely psychological nature. Rogers' analysis shows

Table 3.1 A Comparison of Diffusion Research Traditions (adapted from Rogers)

| Tradition | Main method of data gathering | Main method of analysis |
|---|---|---|
| Anthropology | Participant observation | descriptive analysis |
| Early Sociology | Secondary sources | a type of statistical analysis |
| Rural Sociology | Personal interviews | statistical analysis |
| Education | Mailed questionnaire | statistical analysis |
| Industry | Case studies | statistical analysis |
| Medical Sociology | Personal interviews | statistical analysis |

each tradition of diffusion research to favour one particular method, but, apart from anthropology, each uses some kind of statistical analysis to process the data.

The increasing use of statistical analysis has been influenced by the greater access the researcher has to the computer as a powerful tool in analysis, but an additional factor, in educational research, has been a call for research to be more "scientific". Holmes (1972) complained

> "Everyone is working very hard, ploughing his own furrow and providing a great deal of useful information, but much of it is news, not science....."

**Brehaut** (1974), discussing the slow growth of educational research in Britain as a whole, shows that, while it is difficult to arrive at any consensus of opinion as to what constitutes educational research, recent statements, such as Nisbet and Entwhistle (1970) "restrict attention to quantitative or scientific methods of investigation".

The meaning of "scientific", in this context, is implicit and not defined, but the seeking after scientific rigour appears to be related to the need to show research to be free from bias and political or ideological influence (though not all agree that bias is avoidable and that values can,or should, be excluded), or the wish to increase the power of educational studies as a science, using natural science as a model.

Mouly (1970) discusses the latter constraint thus:

> ".... as a science, education is almost exclusively at the empirical level.......... empirical science is particularly limited from the stand point of predictability and control, which are the ultimate purposes and goals of science ........ the more advanced the science, the greater is the need for it to go beyond enumeration toward ever greater precision in measurement in order to permit the more adequate analysis of phenomena through mathematical manipulation".

But the quantification of data is problematical. Mouly quotes Coombes as claiming:

> "The social scientist is faced by his dilemma when he chooses between mapping his data into a simple order and asking his data whether they satisfy a simple order. ........By selecting a strong enough system the social scientist can always succeed in constructing a unidimensional scale of measurement, commonly an interval scale, thus requiring a portion of the data to be classified in error".

When quantification *is* used Torgerson (1958) insists

> "there must be the same relationship between characteristics of the numbers system employed and the relations between various quantities (instances) of the property to be measured".

The danger of forcing data to display simple relationships of doubtful validity, and then to operate mathematically on these, is not the only problem confronting educational research of a sociological nature. Cicourel (1964) discusses the concern shown by some

> "with how science controls the thoughts of its adherents by the way colleagues influence decisions about such matters as which problems will be deemed worthy of study, which techniques should be adopted, how to measure events and conceive of them, how to state and publish results, and which results and theories will be acceptable........."

If the self-conscious desire to be scientific is paramount the selection of research problems in education may be influenced by their amenability to quantification rather than their theoretical or practical value and therefore may result in esoteric studies with little apparent significance for the classroom. Brehaut finds that those British scholars who have written guides on the conduct of research have stressed the need for this research to remain close to the reality of the teaching-learning situation. He quotes Wall (1968) as remarking

> "We must remember that it isn't enough to have a degree in a social science and a couple of bright ideas......There is a kind of intuitive knowledge of schools, teachers, children and parents that can be acquired only by some years of real teaching experience".

while Taylor (1973) claims

> "In practice the best research teams are often a mixture of young, methodologically sophisticated and tough-minded social scientists, and more experienced, school orientated educationists".

but he fails to indicate by what criteria the "best" teams are judged, nor the roles appropriate to their differently qualified members.

The present writer, having engaged in the case-study programme for the Curriculum Diffusion Research Project, has found herself highly sensitive to this debate. It is suggested here that the development of diffusion research, in its infancy in this country, may be distorted and constrained if only particular types of data, processed statistically, become the acceptable norm. For within this orientation the interview method of data-collecting is highly suspect and regarded as open to bias; the training of interviewers transforms them into robots with standard reactions, even of facial expressions, to each anticipated response (Cicourel, 1964); case-studies are particularly weak, describing single instances only - they may provide "useful information", but it is "news, not science".

In an interesting and challenging paper MacDonald and Walker (1975) comment on the methodological difficulties faced by curriculum evaluators (whose enquiry has much in common with curriculum diffusion) in their search for answers to questions posed by teachers and administrators. Evaluators, they claim, have been drawn towards the case-study as a technique. They comment:

> "It is difficult to account for the neglect of the case-study as a general method of educational science, especially in view of its significant role in the history of learning theory. An adequate explanation would need to embrace the following considerations: aspirations to the status of the natural sciences via the adoption of their alleged paradigm, bureaucratic demands for acturrial data susceptible to policy manipulation, genuine scepticism about the research value of the approach, and the late arrival on the educational scene of research practitioners with relevant skills."
>
> "But there is another reason for this neglect, one which has status implications, but which poses a dilemma for the aspiring educational scientist in a curious form. It has to do with the fact that the kind of case-studies which we believe education needs have characteristics which call for a fusion of the styles of the artist and the scientist...... Case-study is the way of the artist, who achieves greatness when, through the portrayal of a single instance locked in time and circumstance, he communicates enduring truths about the human condition".

The problem facing any artist is the recognition of the "truth" embodied in his work. This arises only when his audience sees in it a powerful expression of their own experience. Curriculum diffusion is conceptually a relatively new phenomenon, moreover the perspectives of groups involved in it vary considerably[1], depending on their roles as initiators, transmitters or consumers of curricula. Thus the early emergence of a consensus recognition of the "truth" of a qualitative diffusion study is slight.

## The choice of research method

Within each methodological approach there are strengths and disadvantages. The type of problem selected for study can determine the choice of method, but resources available to the researcher frequently influence his decisions. A survey conducted by mailed questionnaire reaches more individuals than can be covered by interviewing schedules for the same expenditure. The strengths of the former lie in the identical format it presents to each respondent and the ease with which a well-designed questionnaire may be coded and analysed. Its weaknesses lie in the assumption that a particular item will be interpreted by all respondents in an identical way, in the often high proportion of non-respondents and in the imposition of quantification discussed earlier.

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[1] See Chapter 17

Some interview schedules are so rigorously controlled in intention that they differ from mailed questionnaires only in their more successful pursuit of non-responders, their cost and in the additional human error introduced by deviant interviewer behaviour.

The more open interview, in common with the case-study, and often forming part of its technique, can follow unanticipated leads and unusual responses, but is faced with problems of data analysis, interpretation and presentation. The researcher is liable to become involved in the issues, events or situations under study, he assures confidentiality of data and yet must report his findings, preserving anonymity, while enabling his audience to check his interpretations of data.

Denzin (1970) suggests

> "..... that no single method is free from flaws- that no single method will adequately handle all the problems of causal analysis - and no single method will yield all the data necessary..........Consequently, the researcher must combine his methods in a process termed triangulation; that is, empirical events must be examined from the vantage provided by as many methods as possible".

### Methodological problems encountered in this study

As reported in Chapter 2, a variety of methods was used to gather information in the Curriculum Diffusion Research Project. This enabled the research to exploit the strengths of each method, but exposed it to a multiplicity of problems. Those encountered in the questionnaire study are discussed elsewhere[1]; those associated with the studies described in this thesis are discussed briefly below, together with the solutions, or compromises, adopted.

### The use of the O level entry figures

The records of candidates entering for the special Nuffield examinations provided, in some respects, the complete data over time suitable for diffusion studies, and have been used in Chapters 5, 6 and 7 to discuss associated variables. There were drawbacks, however, to their use. Examination entries were relevant only to courses leading to public examinations. The entry figures, with the corresponding information about sex of candidate and type of school, collected each year for the C.D.R.P., were provisional only and, in some years, varied considerably from the final figures of candidates sitting the examinations. Proportional adjustments were made where these differences were critical (e.g. in the calculation of percentage pass rates) but it could be argued that the provisional figures submitted by schools to the boards validly represented pupils following the course.

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[1] See report of the Curriculum Diffusion Research Project, available from the Library, Centre for Science Education, Chelsea College, Bridges Place, London, S.W.6.

A further limitation to the use of examination entries is that they provide no measure of the partial use of materials by teachers who wish to supplement their own courses, or to use complete parts of the course for younger pupils. However, the use of materials to examination is an acceptable measure of full adoption and as such is a useful diffusion indicator.

## Other records

It was suggested in Chapter 1 that the curriculum development movement was a pragmatic response to events and concerns of the time. The participants had little sense of making history, so that no effort was made to preserve records of the early projects after they had served the projects' purpose. Some survived two moves of the headquarters' offices but for no project were they complete.

An appeal made through the Bulletin of the Association for Science Education produced two useful collections of information about early dissemination. These were used in the discussion in Chapter 8.

It was anticipated that local education authorities kept records of support given to schools and teachers in connection with curriculum projects, but few had done so. This created problems in testing the hypotheses generated from the communication-support system, which were not entirely resolved.

## Adoption and use of materials

For the purpose of the C.D.R.P. "adoption" was conceptualised as the use of project materials. This did not subsume how they were used and so did not include implementation.

Where correlates were sought in this study the dependent variable was the level of use of projects. All other variables were regarded as independent. This does not exclude the possibility that the causal relationship may operate in the opposite direction (indeed, where the change in number of science advisers is discussed[1], it is suggested that this variable is partially dependent on the demand from the schools for support to use science project materials).

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[1] See Chapter 13

In Chapter 6 the total number of schools using a project to examination in each category of school represents the level of use, and simple percentages are calculated to make comparisons. The problem uncovered here, when the use over time was investigated, was the variation in school organisation that had occurred over the period of diffusion of projects[1].

To obtain a valid representation of level of adoption (to examination) for LEAs, the schools using a project were expressed as a percentage of schools which could be expected to use it. For the O level projects these latter were grammar, comprehensive and technical. The numbers of schools in each of these categories, in each LEA, were obtained from the Department of Education and Science.

In the testing of hypotheses derived from the communication-support system, a reliable and valid estimate of level of adoption was required for the twelve LEAs in the sample. The questionnaire had been sent to the teachers in a 25% random sample of the schools in these LEAs, but the number of responses obtained from each school varied; moreover, each teacher was asked to report on his own actual use of projects, so that no accurate assessment from the questionnaire could be deduced for the school as the adopting unit. In addition, the case-studies had shown that the use of projects was dependent on the recent history of the school. This varied so much from school to school within an LEA, and between LEAs, that a 25% random sample, of what was often a small number of schools, could not be regarded as representative. The hypotheses was somewhat inadequately tested, therefore, using the use of O level projects to examination only.

## The case-study design, procedures and problems

> "Case-study methods are rarely spelled out in advance, except in the most general terms,......In the social sciences.....the method of attack is characteristically an opportunistic response to the observed nature of the case"
>
> (MacDonald and Walker, 1975)

This was so for the "case-study" work in the C.D.R.P. As indicated in Chapter 2, and described in Chapter 11, it grew out of the open interviews with LEAs and was structured via the communication-support concept. It therefore became four case-studies, located in four separate LEA areas.

The procedures used, and the problems encountered, in the conduct of the case-studies are described at the beginning of the Case-Study research report.[1]

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[1] This variation is displayed on P. 6.04

The communications schedule was the most structured, requiring only responses to fixed questions. Attempts to save interview time by asking respondents to complete the schedules personally were not successful as this schedule contained some personal questions[2]. These were acceptable to the teacher only if, and when, his confidence had been gained and he saw the relevance of the questions to the enquiry. For this reason the communications schedule was administered only after the more objective area of perception of projects had been explored.

The sample of teachers to whom the schedule was presented was determined by the time that each teacher had available. Because of this no statistical analysis of results was attempted, but the analysis was presented in semi-quantitative terms, using the expressions "a few", "some", "many", which in the order shown here, represent an increasing proportion of those interviewed.

The enquiry into perceptions was conducted using a tape-recorder and a lightly-structured list of questions[3]. Not all of these were actually asked, if the information had been forthcoming earlier, or so little familiarity with the project was shown that further questioning was inappropriate.

In these interviews, and in the discussions of decision-making, the interviewer was conscious of a complex social interaction with the respondent, which was controlled intuitively against a background of certain broad expectations or conventions, some deriving from social relationships and some from the rules of research.

The first few minutes of each interview were crucial in establishing confidence in the interviewer and acceptance of the purposes of the enquiry. The interviewer, keeping in mind the need to limit her influence on the outcome of the interviews, was concerned to note how often her background appeared to be important and how frequently earlier insights were invoked in the course of interviewing. Densil (1970) states:

> "Two conventions characterise most interviews and seem to give this particular mode of personal encounter its uniqueness: these are the conventions of equality and comparability".

The interviewer was conscious of the need to establish equality before both participants were able to relax and proceed with the exchange of information. Comparability was abandoned in this process as different techniques or images of the interviewer were required for different respondents, (this led to a difficult interviewing situation when more than one respondent

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1. See Appendix S, pp S.01 - S.04
2. See Appendix R (iv)
3. See Appendix R (iii)

was present). For the experienced science teachers her years of teaching science and knowledge of the three sciences was important, for young teachers her recent experience of the problems facing students in the classroom established a kind of quality, while for some headteachers a lecturer in a college of education had status. (One wonders what different data would have been forthcoming from a "young, methodologically sophisticated and tough-minded social scientist" conducting the interviews).

In the research report a comment was made that a surprising number of teachers welcomed the opportunity to talk; Denzil accounts for this in the following way:

> "by offering a programme of discussion, and an assurance that information offered will not be challenged or resisted, self-expression is facilitated to an unusual degree and this is inherently satisfying........the interview is an understanding between the two parties that, in the return for allowing the interviewer to direct their communication, the informant is assured that he will not meet with denial, contradiction, competition, or other harassment. As with all contractual relations, the fiction or convention of equality must govern the situation".

The interaction process of interviewing with a tape-recorder was complex. Most teachers assured the interviewer that the tape-recorder "made no difference", but became embarrassed and inhibited if the interviewer's attention was at all directed towards the machine. Any anxiety about the tape running out or level of recording had therefore to be suppressed. It is imperative that the interviewer be totally familiar with the machine to be used.

The interviewer was aware of operating at several different levels at once: there was the need to keep the flow of questions going without the pause associated with the written record of response; at an internalized level, all personal reaction of surprise, objection or approval on the part of the interviewer had to be suppressed and, perhaps, processed into further question that conveyed acceptance of the respondent's viewpoint, but explored it further. That any response was unexpected indicated that the interviewer was constantly measuring responses against the perceived situation as it was unfolding, and her expectations arising from prior insight and experience.

Hoggart (1967), in a paper presented to the sociological section of the British Association, asks how a creative writer's way of arriving at "truth" compares with that of a social scientist. "Social insight" arises from a writer "holding in his imagination" an enormous amount of material.

The writer makes his "significant explorations" not by "conscious controlled aggregation", but by "imaginative power".

This writer suggests that the educationist with wide experience of schools, teachers and the education system is striving to operate in this way, when observing, interviewing and discussing, in order to make sense of the diffusion and implementation of change.

The open interview emerged for the interviewer as a powerful tool for creating personal insight into the operation of the innovation-decision process. The sharing of this insight, its presentation in a form that makes possible its acceptance by other researchers in the field or by those involved in the process of change, remains a problem.

The perception studies are reported in two modes: in the research report[1] the comments made in each school in answer to the standard questions are collected together for each project included in the study, while more extended comments are used to discuss the stances that teachers appeared to assume in relation to curriculum projects in general[2]. The former displays more or less raw data, while in the latter data have been used selectively to support patterns detected by the interviewer.

Data on which the discussion of decision-making is based are presented in the case-study report[3], for each school visited. They include information about any special characteristics of the school, the structure of the science courses, comments made by teachers and some judgements on the teachers themselves. These latter are made very tentatively, but appear to be inescapable: in an educational system that acknowledges the teacher's professional responsibility for classroom activities, the attitudes, assumptions and skills of individual teachers will influence decisions about which course to use and how it is taught. The interviewer used no measures of characteristics[4] such as "leadership" or "openness to change", but puts them forward as possible dimensions for further investigations of correlates of adoption behaviour.

The dilemma faced by the writer is that, although these judgements about teachers are personal and subjective, without them the evidence on which the decision-making discussion is based is incomplete; moreover, to include characteristics that inevitably imply judgements of value, appears to break, for some, the "contract" that they should meet with no "other harassment" after parting with information; moreover, the comments, presented as they are within the context of specific information about

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1. Appendix S(ii)
2. Chapter 16
3. Appendix S(iv)
4. See Appendix S(iv) pp S35 and 36 and Chapter 17 for discussion of teacher characteristics

schools and LEAs, may lead to identification of individuals and hence a loss of anonymity and a real, although not a technical, breaking of the pledge of confidentiality.

MacDonald and Walker (1975) discuss the ethics of case-study interviewing and the possession of the resulting data, suggesting that the respondent has the right to censor information obtained from him in open interview, even though this may mean for the researcher "that some of his finest data is lost, diluted or permanently consigned to the files". No such arrangements were made within the C.D.R.P., although confidentiality was assured. The case-study report is included as an appendix to this thesis on the professional assumption that information in it will be perused only for serious research purposes.

## PART II THE NATIONAL PERSPECTIVE

## CHAPTER 4

## SOME INDICATORS OF THE USE AND INFLUENCE OF PROJECTS OVER TIME

The Nuffield Science Teaching Project was set up in 1962. Within its compass materials intended for use by various groups of pupils were developed, tested in schools and finally published.[1] No monitoring of dissemination or the use and influence of projects was contemplated in the early years. Various unco-ordinated attempts were initiated by institutions or individuals, with an interest in or responsibility for curriculum development, to find out what sort of response to the projects had occurred. The Schools Council carried out a survey of the use of the O-level projects within LEAs in 1968[2] (two years after publication), and an enquiry in the South West was made from Exeter University in 1970[3]. Jenkins (1971) used the O-level entries to discuss the implementation of the Nuffield Chemistry project in 1969. Kelly (1973) initiated a study of the diffusion of the A-level Biology project as a pilot for the more comprehensive Curriculum Diffusion Research Project (C.D.R.P.)

A major problem facing this project was to discover what had taken place in the interval 1966 to 1972. Few LEAs in the C.D.R.P. sample kept records of the progress of the projects in the schools for which they were responsible[4], and the pilot questionnaire to schools revealed the difficulties inherent in this method of collecting retrospective data.

Indicators of use and influence that have survived over time are examination entries, examination papers, sales of publications, text books and some in-service course information. The most complete data, collected by the C.D.R.P. from the GCE boards, are associated with examination entries and these are discussed in Chapters 5, 6 and 7. A discussion of in-service education for teachers is expanded in Chapter 8, while some attempt is made in this chapter to present a picture of the use and influence of the projects in the interval 1966 to 1972, using the remaining sources and the C.D.R.P. questionnaire to head teachers (1972).

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[1] Mary Waring (Centre for Science Education, Chelsea College) is currently developing a study of the origins and early developments of the Nuffield Science Teaching Project.

[2] "The Nuffield Science Teaching Project", Education in Science, No. 32, April 1969.

[3] Thorpe, C.W. (1970) "Nuffield O-level Science in the South West", The Institute of Education, Exeter University.

[4] See discussion in Chapter 12.

## The Schools Council Survey (1968)

In a letter to Local Education Authorities in March 1968 the Schools Council requested information about the number of schools using the O-level Nuffield materials "sub-divided to show which subjects they are using and what stage they have reached in each subject". 120 (out of 163) Local Authorities replied. This is a high response rate of 74%, perhaps indicating the professional responsibility for the curriculum accepted by the authorities, or their commitment to the Schools Council.

The replies are summarized below.

Table 4.1. Stages reached in Physics, Chemistry, Biology (1968)

This table gives the numbers of school science departments having reached each of stages 1-5 in each of the three sciences. The column marked 'A' denotes those areas which gave an aggregate total of departments using the materials, with no sub-divisions to indicate the stage reached.

England and Wales

| | Yr.1 | Yr.2 | Yr.3 | Yr.4 | Yr.5 | A | Total |
|---|---|---|---|---|---|---|---|
| Physics | 248 | 128 | 84 | 34 | 34 | 105 | 633 |
| Chemistry | 224 | 125 | 80 | 31 | 26 | 98 | 584 |
| Biology | 222 | 105 | 82 | 31 | 40 | 103 | 582 |
| | | | Total number of Departments: | | | | 1799 |

The variation in responses from LEAs limited the accuracy of the survey and the interpretation placed on its analysis. No attempt was made to distinguish full or partial use of materials at any stage, and a comparison of Year 5 figures with O-level entries for 1968 is meaningless since for about one sixth of the departments said to be using materials no sub-division of stages reached was available.

With these reservations the survey reported that the materials were used in 108 LEAs, in some 1800 departments of about 1000 schools. Of these an approximate 15% were assumed to be secondary schools so that of the 1980 grammar and comprehensive schools then in operation over 43% appeared to be using the materials in some form.

There was little difference between the three sciences in the pattern of reported use. The progression from Year 1 to Years 4 and 5 looks at first sight to indicate an increasing use that could be anticipated to move through the schools. However, sales of publications data and information collected during case studies suggest that the projects are all more extensively used in some form in the first two or three years of the 11-18 school than in years 4 and 5. The influence of public examinations, combined with teachers' perceptions of the relative difficulty of the Nuffield examination emerged in the Thorpe study of the South West discussed below.

### Nuffield 'O' level Science in the South West (1970)[1]

During the summer of 1970 Thorpe conducted a questionnaire enquiry in some 230 schools into the use of the Nuffield O-level schemes in the South West (LEA areas: Devon, Cornwall, Exeter, Plymouth, Torbay, part of Dorset and Jersey).

He obtained just over 60% response rate to the questionnaire from grammar and comprehensive schools but only 40% from secondary modern schools. These latter did not appear to make much use of projects and their data were excluded from the analysis discussed below. In addition to the questionnaire survey, visits were made to 29 "representative schools".

Table 4.2. Percentage of schools using materials

| Year of course | Biology | Chemistry | Physics |
|---|---|---|---|
| 1 | 62 | 62 | 57 |
| 2 | 57 | 55 | 51 |
| 3 | 33 | 27 | 25 |
| 4 | 18 | 19 | 7 |
| 5 | 8 | 11 | 5 |
| No. schools responding | N=61 | N=63 | N=61 |

12% to 16% of the responding schools reported no use at all when the three sciences were considered separately and it must be expected that non-responders were more likely to be non-users. Again, little variation between the three sciences was demonstrated, but when it came to planned use of the special Nuffield examinations there was much less certainty about their use in Biology than in the other two subjects. The general trend "seems to be to teach years 1 and 2, often with considerable modification, but not to continue using much of the scheme, nor to aim for the examination". Apparently no school was prepared to commit itself to entering candidates in 1974.

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[1] C. W. Thorpe (1970) "Nuffield 'O' level Science in the South West", The Institute of Education, Exeter University.

In Chemistry "more schools are taking the course right through to Nuffield examination, but even so, many are stopping the full scheme after Stage One and adapting the course for the traditional 'O' level". Nearly one third of schools reported planning to enter groups for the Nuffield papers in 1974.

Similarly in Physics "many schools are adopting the first two or three years of the course, with little modification; but there is often hesitation about years four and five". However, just over one quarter of the schools planned to enter candidates for the examination in 1974.

In each science, by 1969 about one third of responding schools had received special Nuffield grants from their LEAs and in about three quarters of the schools at least one teacher had attended an in-service course, when each science was considered separately. (Some had attended more than one course and in some schools more than one teacher had attended a course in a given science.)

The availability of money was less frequently reported as a limiting factor in the use of materials than laboratory accommodation, laboratory assistance and the unsuitability of materials for pupils, as Table 4.3 shows.

Table 4.3. Reasons given for not attempting Nuffield work, or being frustrated while doing so

| Reason | Biology | Chemistry | Physics |
|---|---|---|---|
| Lack of teaching time | 11 | 7 | 9 |
| Lack of money | 8 | 7 | 13 |
| Lack of laboratory accommodation | 25 | 19 | 25 |
| Lack of laboratory assistance | 36 | 29 | 35 |
| Lack of storage space | 5 | 6 | 6 |
| Unmodified materials unsuitable | 14 | 12 | 19 |
| No. of schools responding | 61 | 63 | 61 |

When the teachers' attitudes to the special Nuffield examinations were explored "various points seemed to be significant:

i) Reluctance to change to any unfamiliar examination anyway.

ii) Lack of knowledge of the percentage passes in the Nuffield examinations, or a feeling that the published figures are not relevant since only selected pupils are being entered for the Nuffield examinations.

iii) The conviction of many teachers that the examinations are too difficult for any but the ablest pupils.

iv) The introduction of Mode 3 Nuffield-type CSE exams.

v) The changes being made in the syllabuses of several Examining Boards."

The report does not make clear whether all these factors acted to restrict the entry of groups to the Nuffield O-level examinations. The same attitudes were found among the teachers in the four LEA areas included in the C.D.R.P. case studies, but in these the availability of a Mode I or Grouped Schools Mode 3 CSE syllabus and examination locally in a science facilitated the use of the Nuffield GCE examinations as groups could be taught together or parallel, allowing a decision to enter a particular pupil for GCE or CSE to be made as late as possible.

The Curriculum Diffusion Research Project survey of use of projects in 1972.

The head teacher questionnaire[1] was sent to the heads of an 8% random sample of all schools in England and Wales, selected for the C.D.R.P. by the D.E.S.

Table 4.4 shows the heads' reported use of projects and their perceived influence of individual projects in their schools. As with the Schools Council survey, no attempt was made to distinguish between full or partial use[2] and it appears that the O-level projects were used in about one third of all schools in the sample. 60% of the grammar schools were using them, but only 40% (less in Chemistry) of comprehensive schools were doing so, although most contained within them pupils entering for O-level examinations in all three sciences. There may be several factors operating here: differences in social aims, leading to a different educational task being more visible to the teachers, differences in overall ability of pupils attempting O-level examinations[3] or the secondary modern origin of a large proportion of the comprehensive schools in the sample[4].

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[1] See Appendix P (i).

[2] This was investigated in the teacher questionnaire.

[3] See Banks (1969)

[4] Of 128 schools reporting a realized or anticipated change to a comprehensive organization, 91 reported that it would involve expansion of an existing secondary modern school only.

**Table 4.4.** Heads reporting use and effects of national curriculum development projects in their schools (8% national sample N = 289)

| | Projects[1] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Hu | PT | B | C | P | CS | SS |
| No. schools reporting use | 84 | 33 | 99 | 86 | 92 | 81 | 56 |
| % all schools reporting use | 29 | 12 | 34 | 30 | 32 | 27 | 19 |
| % all grammar schools | 8 | 15 | 61 | 62 | 59 | 10 | 2 |
| % all secondary modern schools | 33 | 6 | 18 | 8 | 12 | 33 | 27 |
| % all comprehensive schools | 35 | 18 | 40 | 35 | 42 | 30 | 21 |
| Mean rating of influence all schools[2] | 3.9 | 3.9 | 4.1 | 4.0 | 4.1 | 4.2 | 4.2 |

**Table 4.5.** Percentage of head teachers reporting adoption according to D.E.S. region (8% national sample)

| | | Projects[1] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| D.E.S. Region | No. Schools | Hu | PT | B | C | P | CS | SS |
| North | 21 | 38 | 19 | 29 | 29 | 29 | 33 | 14 |
| Yorkshire | 23 | 26 | 13 | 14 | 35 | 39 | 22 | 17 |
| East Midlands | 33 | 43 | 6 | 27 | 24 | 27 | 9 | 15 |
| East Anglia | 13 | 38 | 0 | 46 | 31 | 23 | 38 | 23 |
| Outer London | 20 | 25 | 15 | 30 | 30 | 30 | 20 | 25 |
| South East | 53 | 32 | 11 | 38 | 30 | 36 | 30 | 15 |
| South West | 29 | 21 | 21 | 31 | 31 | 38 | 48 | 21 |
| West Midlands | 33 | 15 | 6 | 45 | 30 | 36 | 46 | 30 |
| North West | 44 | 27 | 11 | 34 | 30 | 27 | 16 | 18 |
| Wales | 20 | 25 | 10 | 15 | 15 | 25 | 25 | 10 |
| Total | 289 | | | | | | | |

---

[1] Key to projects -
Hu = Humanities Curriculum Project
PT = Project Technology
B = Nuffield O-level Biology
C = Nuffield O-level Chemistry
P = Nuffield O-level Physics
CS = Nuffield Combined Science
SS = Nuffield Secondary Science

[2] 5- considerable desirable effects
4- some desirable effects
3- no effects
2- some undesirable effects
1- considerable undesirable effects

A small proportion of secondary modern schools did report use of the O-level projects and it is known that some Mode 1 and grouped schools Mode 3 syllabuses make reference to Nuffield O-level science materials.[1]

About one third of all secondary modern and comprehensive schools were using the Combined Science and somewhat fewer the Secondary Science, but it must be remembered that the survey was conducted two years after the publication of the former and only one year after the latter's publication. A reluctance to use Secondary Science in comprehensive schools was detected in the case studies, however.[2]

The majority of heads in the sample perceived the effects of the use of the projects in their schools to be desirable and were most welcoming of Secondary Science and Combined Science. A more detailed perception of curriculum development projects in general is discussed later.[3]

A further analysis of reported use of science projects into D.E.S. regions in England and Wales was attempted. This resulted in rather small sub-samples of schools in some areas and no representative distribution of types of school, so that care must be taken in interpreting the results which are shown in Table 4.5. One may perhaps comment that the West Midlands region emerges as a high user of all science projects, while the East Midlands and Wales are low users.[4] Of interest is the North West region that appears, with Wales, as a low user to examination of the O-level projects, but here, with around 30% of schools reporting use, it is a moderate user.

The percentage of grammar and comprehensive schools reporting some use of the O-level projects'materials had risen from the 43% of the 1968 survey to around 60% in 1972 (although Thorpe reported this level of use in Year 1 in the South West in 1970).

As a matter of interest the project load on schools was examined. 17% of schools reported no use made of projects. Over one third of schools used one or two projects while 20% of them reported use of five or more of the projects listed (see Figure 4.1). It is possible that these last schools are, for some reason, more open to change or innovation. Their characteristics would make an interesting study.

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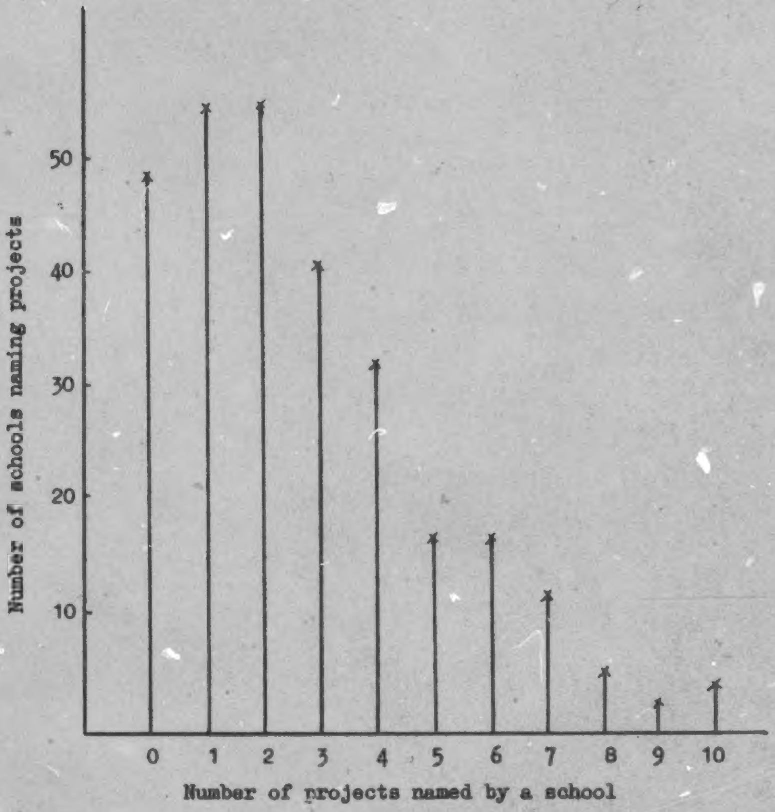
[1] See Thorpe's study of the South West and, e.g., the Southern Region Examinations Board syllabus.

[2] See Chapter 17.

[3] See Chapter 16.

[4] Jenkins (1971) detects a clustering of schools using the Chemistry project around the original centres of project activity in 1969.

Fig. 4.1. Variation of number of schools naming projects and the number of projects named



## Sales of publications as an indicator of interest and use

Each separate project team within the Nuffield Science Teaching Project had the freedom to develop materials for publication according to their own interpretation of need or in response to feed-back from the schools. This resulted in a variety of texts to serve specific ends, which must be taken into account when patterns of sales of publications are discussed and compared.

Briefly, the Biology O-level project prepared a teachers' guide and a pupils' text for each of the five years of the course. The Physics project produced both a teachers' guide and a guide to experiments, together with a pupils' question book, for each of the five years of the course. In Chemistry, a rather different, more complex, pattern emerged, with an "Introduction and Guide" giving the philosophy of the enterprise, a "Handbook" giving up-dating background, and two volumes of a Sample Scheme (Stages I and II and Stage III) all directed at teachers. For the pupil there were background readers, a book of data, and experiment sheets (Stage I - two alternatives - and Stage II).

Combined Science settled for "Teachers' Guides" and pupils' "Activity Packs", each in two volumes, with a further apparatus guide for teachers or technicians.

For Secondary Science there were no published materials for the pupil. Each "theme", containing discussion of appropriate levels of treatment, experimental work and sample work sheets, was published separately, together with a teachers' guide, an apparatus guide and advice on how to use the materials for a CSE examination.

In spite of this variation it is possible to detect certain significant patterns. The graphing of quarterly figures high-lighted the period of maximum sales each year as the third quarter for pupils' texts (reflecting the submission of requisitions in schools at the end of the summer term), but this is not necessarily so for teachers' books. Annual sales showed fewer irregularities, but a problem arose in interpretation of the first year of sales, which was most likely not to cover a twelve month period.

The pattern for pupils' texts in biology and physics were very similar and are illustrated by Figure 4.2. The remarkable characteristic of this is the peak of sales for Year 1 in the first full year following publication, which then moves to sequential years and reduces as the pupils for whom the Year 1 materials were purchased moved through the school and some ceased to study the subject when options were offered

Fig. 4.2. Smoothed curves showing typical sales for Nuffield O-level science pupils' texts when separate texts were produced for each year of the course.

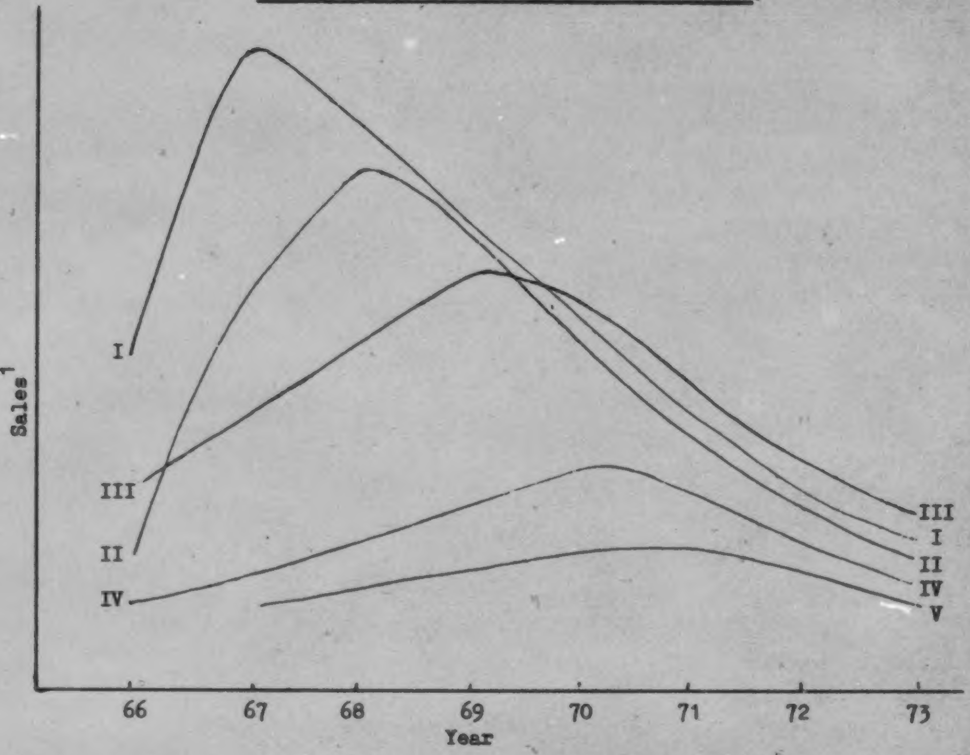
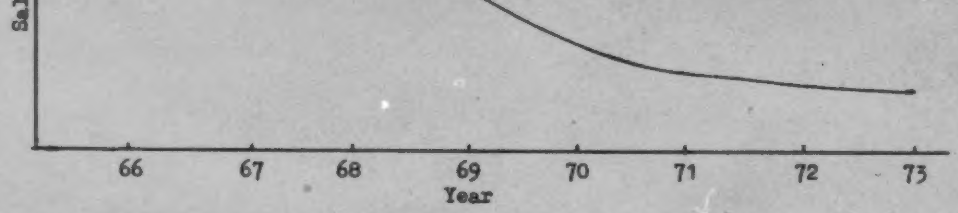


Fig. 4.3. Smoothed curve showing typical sales for Nuffield O-level science Teachers' Guides



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1. Data on sales are confidential and were made available to this study only on the understanding that actual figures would not be displayed in the report.

(usually in Year 4), or teachers developed doubts about the suitability of the examination for their pupils.[1]

The early and continuing relative popularity of Year 3 materials reflects the school organization from which Year 3 emerges as the year in which the specialist science teacher is most likely to be able to teach his specialism to all pupils.

A special characteristic of physics is that the Year 1 peak occurred in 1968, not 1967, and although the subsequent years peak in the same year as biology (i.e. Year 2 physics also shows a maximum in 1968) the peaks are sharper - the sort of effect one would get by compressing the biology curves topologically, from the left, without altering overall numbers appreciably. But this is consistent with the slow start for Nuffield Physics that examination entries also show.[2] There were, however, appreciably greater sales of the first three years of the Nuffield Biology pupils' texts than of the Physics questions books for these years, perhaps reflecting their different purpose and dispensibility more than the greater use of the course.

For the chemistry pupils' materials there was a similar peaking for the two Stage I (Years 1 and 2) alternatives in 1967 and a (much reduced) peak for Stage 2 (years 3 and 4) experiment sheets in 1969.

The smoothed curves for all five years of "Teachers' Guides" in both Biology and Physics follow the pattern shown in Figure 4.3, with sales for corresponding years similar and with early years of the course initially slightly more popular than later years. From 1971 through 1973 the sales have stabilized with only a very slight fall with time. For corresponding teacher/pupil texts there is a ratio of about 1:8, indicating, perhaps, constraints operating on the use of pupil texts, or, more likely, the lack of correlation between familiarity and use found in other parts of the C.D.R.P. Study.[3]

In chemistry again, a similar general shape to the curves was obtained for all teacher materials (ignoring an abnormal first two years for the Teachers' Handbook), but the curves show the unmistakable relative popularity of the Sample Scheme (Stages 1 and 2) which has maintained, in recent years, twice the rate of sales of most of the other teacher-materials produced by any of the O-level schemes.

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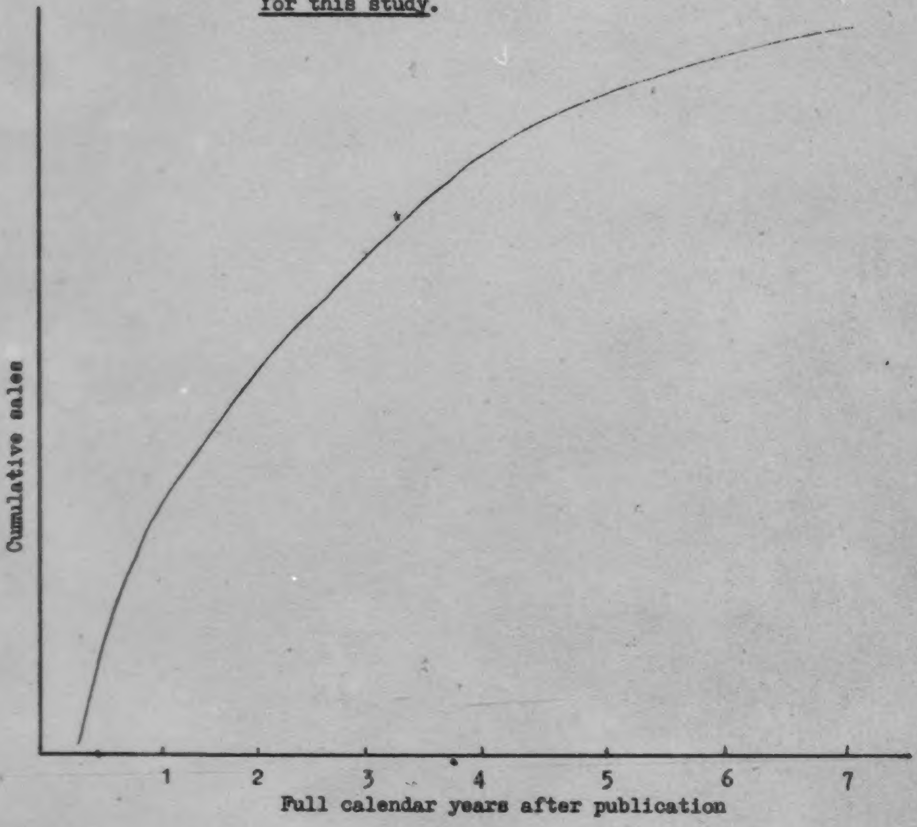
1. See note at the end of this chapter.
2. See Chapter 5, Fig. 5.
3. See report of the Curriculum Diffusion Research Project, available from the Library, Centre for Science Education, Chelsea College, London.

Taken cumulatively over the years none of these figures suggests an S-shaped adoption curve, but rather an initial interest followed by a sharp fall and a gradual tailing-off. (See Figure 4.4.) Perhaps the artificial constraint of the restriction of use of the materials to the trial schools during the developmental years of a project produces a damming effect followed by a released flood on publication.

Fig. 4.4. A typical curve showing cumulative sales with time for most Nuffield project materials analysed for this study.



Although it is early years to be drawing conclusions from sales of Combined Science and Secondary Science, it appears that the former is showing a similar pattern to Years 1 and 2 for the separate O-level projects, with similar numbers of sales for their early years. For Secondary Science the sales of most "themes" were very similar and marginally greater in 1972 than in 1971. They were about 25% down in 1973, when they were selling at about the same rate as the Chemistry Sample Scheme, Stages 1 and 2.

## The influence of the O-level Nuffield Science Schemes on text-books.

No systematic study of text-books was undertaken, but the writer consulted with the staff of the separate subject departments in the Centre for Science Education, Chelsea College, and examined text-books held in the departments for the use of students. The following observations were made.

(i) Biology. Out of 23 books for pupils (CSE, GCE 'O' and 'A' level) published since 1966 only two did not mention the Nuffield projects in biology; some mentioned also the American High School projects.

(ii) Chemistry. Few books had been published since 1966, reflecting the Chemistry project team's move away from the use of a pupils' text. One of the project team had, in fact, later produced a series of "foreground" books for use with the Nuffield materials. Of two comprehensive texts (published 1970 and 1972), both sets of authors acknowledged their "great debt" to the Nuffield O-level Chemistry project.

(iii) Physics. Five series of textbooks, published since 1966, acknowledged the influence of the Nuffield projects. One made reference generally to "new syllabuses", and one emphasized a change to the "ideas of physics". Post-1966 editions of two very popular text-books included trolleys and ripple tanks and one mentioned a move from "everyday life" applications to "fundamental ideas".

This somewhat cursory glance at text-books suggests that publishers and authors have been heavily influenced by the Nuffield Science Teaching Project, or have recognized the advantage to sales of declaring an association with the projects or their objectives.

## Changes in Examination Boards.

As reported in Chapter 16, teachers perceived the O-level projects as having caused other examining bodies to change their syllabuses and modes of examining. No enquiry into this was initiated within the C.D.R.P. but several other studies have touched on the relationships between the Nuffield and other syllabuses and examinations.

## Chemistry Examinations

Giddings[1] attempted an analysis of question papers in O-level Chemistry in terms of the following criteria:

Questions involving mainly i) recall
ii) numerical calculations
iii) graphical interpretation
iv) data interpretation
v) synthesis

For the Nuffield papers over the six years of 1967-72 he detected a fairly constant 30-40% "recall" questions, about 10% "synthesis" (after 1967, in which none was detected), 5-10% "graphical interpretation" and the remaining 45-50% involved "data interpretation" and "calculations", the relative proportions of which varied considerably from year to year.

He then analysed the 1968 and 1972 chemistry O-level papers of the eight GCE boards in a similar way and concluded that the influence on the other boards of the Nuffield objectives, reflected in the examination, was slight. Only in the London[2] papers did the change in frequency from 1968 to 1972 of recall questions bring this to below 50% (64 → 45%). Northern Ireland and the Southern Universities Joint Board also showed a reduction in recall (74 → 57% and 72 → 58% respectively), but Cambridge (60 → 66%), J.M.B. (64 → 77%) and Oxford and Cambridge (58 → 78%) appeared to show an increase in recall items when the two years were compared. Wales (70%), Oxford (76%) and A.E.B. (72%) showed little change. In 1972, graphical interpretation was not required in any papers except for London and S.U.J.B., while data interpretation items formed around 5% of questions in 7 boards, being highest again in London and S.U.J.B. papers.

It is a pity that the analysis of papers was restricted to two years only, as no stability of trends was demonstrable as in the case of Nuffield papers.

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[1] A. P. Giddings, "The Assessment of the Nuffield 'O' level Chemistry Course". Unpublished M.Ed. Dissertation, Chelsea College, 1973.

[2] The London Board administers the Nuffield Chemistry examinations.

## Biology syllabuses and examinations

Lerner[1] has attempted to identify differences between Nuffield Biology and a more traditional course and examination. She analysed the content of papers set at O-level by London, Oxford and J.M.B. for the years 1969-73 and compared them to Kelly and Monger's[2] analysis of the Nuffield examinations for 1967-70. Differences occurred in the absence of questions on life histories and interpretation of data from the Nuffield examination (while these items each assumed from 5-19% in the others), and the inclusion of a small percentage of questions in Evolution and Behaviour in the Nuffield examinations, while none occurred in the others. Similar emphases on physiology and ecological and environmental topics were seen in all four. Biology papers that displayed the closest resemblance to the Nuffield examination were those of the J.M.B., the board that administered the former examination.

Crossland and Amos[3] have used four categories of abilities required to answer in biology and shown that the pattern of examinations has remained relatively constant over the years 1948/59 and 1960/64, with recall contributing more than 89% of the abilities needed by candidates. Lerner used the same categories to analyse papers for the years 1969/73 and suggested that, for the two boards common to both studies, a shift from simple recall (to around 60%) to more emphasis on interpretation of data and application to new situations has occurred. A corresponding analysis of the Nuffield papers was not attempted but when the simpler categories of "to know" and "to think" (as used by the examiners in their 1973 report) were applied over the 1969/73 period the following pattern emerged:

Table 4.6 Abilities required to answer O-level Biology papers, 1969/73.

| Categories | A.E.B. | J.M.B. | Oxford | London | Nuffield[4] |
|---|---|---|---|---|---|
| To know | 100 | 58 | 78 | 87 | 40 |
| To think | 0 | 42 | 22 | 13 | 60 |

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1. N. Lerner (1974), "The teaching of Biology to girls and some comparisons of the Nuffield and traditional course". Unpublished M.Ed. Dissertation, Chelsea College.
2. Kelly P.J. and Monger G. "An evaluation of the Nuffield O-level Biology course materials and their use". School Science Review, 55.
3. Crossland R.W. and Amos R. Biology and Human Affairs, 26, 1961, pp. 1-4, 30 1965, pp 1-5.
4. Kelly and Monger detect 60% recall in 1967/70 Nuffield papers.

This indicates that the change to a reduced proportion of recall items is in line with the Nuffield emphasis, but that not all boards display a marked shift from recall or "know" to "think".

No comparable studies appear to be available for Nuffield O-level Physics.

That a marked change has occurred in the direction of the Nuffield examinations in both Chemistry and Biology only within the boards that administer the relevant Nuffield examinations suggests that the influence of the teachers using a particular board's examinations is slight. Schools enter candidates for Nuffield examinations through the GCE board commonly used by the school, but the examiners have contact only with the administering board. It appears that the assumption by the board of responsibility for the Nuffield examination, and the contacts made by the board (and possibly other examiners) with the examiners' team, are the causal factors in the change occurring in the board's own papers in the corresponding science.

## Conclusion

The available data have been studied piecemeal in this chapter, but within each set of evidence the penetration of the curriculum projects has been demonstrated. This is particularly true of the O-level projects in the separate sciences. Their materials have been purchased in schools, head teachers welcome their use in schools, more than half of the grammar schools in recent studies report using the projects. Fewer comprehensive schools appear to use them and so, perhaps, the increasing conversions of schools to comprehensives may result in a smaller proportion of pupils having access to the materials than was potentially possible before.

Other factors operate to constrain their use, particularly for older pupils, but their influence has spread to other text books and, to some extent, to other O-level examinations in the sciences, but possibly not as a result of pressure from teachers.

Geographically there may be some differences in the pattern of use and this is explored in more detail later,[1] but the curriculum development project has entered the educational arena and has increased the number of pressures acting upon teachers.

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[1] See Chapters 7 and 8.

Note on shape of curves in Figure 4.2.

The writer was haunted by the familiarity of the general pattern of the curves in Figure 4.2 and finally identified the resemblance to the energy/wave length curves for radiation at different temperatures. After a few moments' thought any analogy was dismissed as impossible, for what match could there be between energy and sales, wave length and year of sale, temperature and age of pupil? There was a perfectly rational explanation for the shapes in the terms of the sequential nature of five texts and the options presented to pupils in years 3/4 of their secondary schooling. Moreover, the teachers could have tried the courses and found them wanting.

But the thought persisted.

The important difference between high and low temperature is that at the former the radiating system has greater organization: there are fewer choices open to it.

It is generally accepted that the teacher is free to make curricular choices and that fewer constraints operate in the earlier years of schooling, i.e. choices are greater. This model could be used to account for the greater response to curriculum projects in the earlier years and to the spread of "progressive" ways in the primary schools (though not to the lack of response to Nuffield Junior Science!)

But what of an alternative model: the teacher does not take the initiative in curricular decisions, but responds to experienced pressures. If these are fewer, then more teachers will respond to a change detected in the climate of opinion and expressed in a curriculum project. In later years of schooling more pressures operate in terms of future studies or employment, there are more factors to be taken into account and therefore more choices to be made. Fewer teachers, therefore, respond to the project if it appears to be in conflict with other pressures.

The writer had already developed a decision-making model in terms of selective response to pressures from case-study analyses (discussed in Chapter 17) and offers this tentatively as further support for the model.

## CHAPTER 5

## USE OF PROJECTS TO EXAMINATION: BY CANDIDATES

The graphing of the number of candidates[1] entering the special Nuffield O-level science examinations since 1966 (Figure 5.1) displays similarities and differences between the three sciences. The lower part of each curve shows the S-growth of most diffusion studies. Chemistry, starting with the largest number of candidates from the trial stage showed the most rapid growth to 1970. Thereafter the physics entries increased more rapidly and, in 1973, overtook the chemistry. Biology has consistently shown a slower rate of increasing use, and in both chemistry and biology there are indications that saturation may be approaching in the use of the full courses to examination. However, it will be necessary to include data for subsequent years before any definite conclusion about saturation is possible. Further, one must look at the use of the special Nuffield examinations relative to the total national entries for O-level sciences.

Table 5.1. Percentage use by candidates 1972 using figures for England and Wales only

| | Total entries[2] | Nuffield entries as percentage of total | |
|---|---|---|---|
| Biology | 168,893 | 6.1 | (using lower entry figure) |
| Chemistry | 92,727 | 15.2 | |
| Physics | 116,825 | 12.5 | |

From this it can be argued that in 1972 physics was less "saturated" than chemistry, while biology was the least saturated. No national entry figures were available beyond 1972 at the time of writing but a glance at the pattern of science O-level entries (Figure 5.2) will show that relatively steady trends have been maintained, with a rate of increase over the years 1967-72 of approximately 5,000 per year for biology, 3,000 per year for chemistry and 4,000 per year for physics. If this rate of growth has been maintained, then in 1973 the projected percentage use of the Nuffield examinations is biology 7.3%, chemistry and physics both 17%.

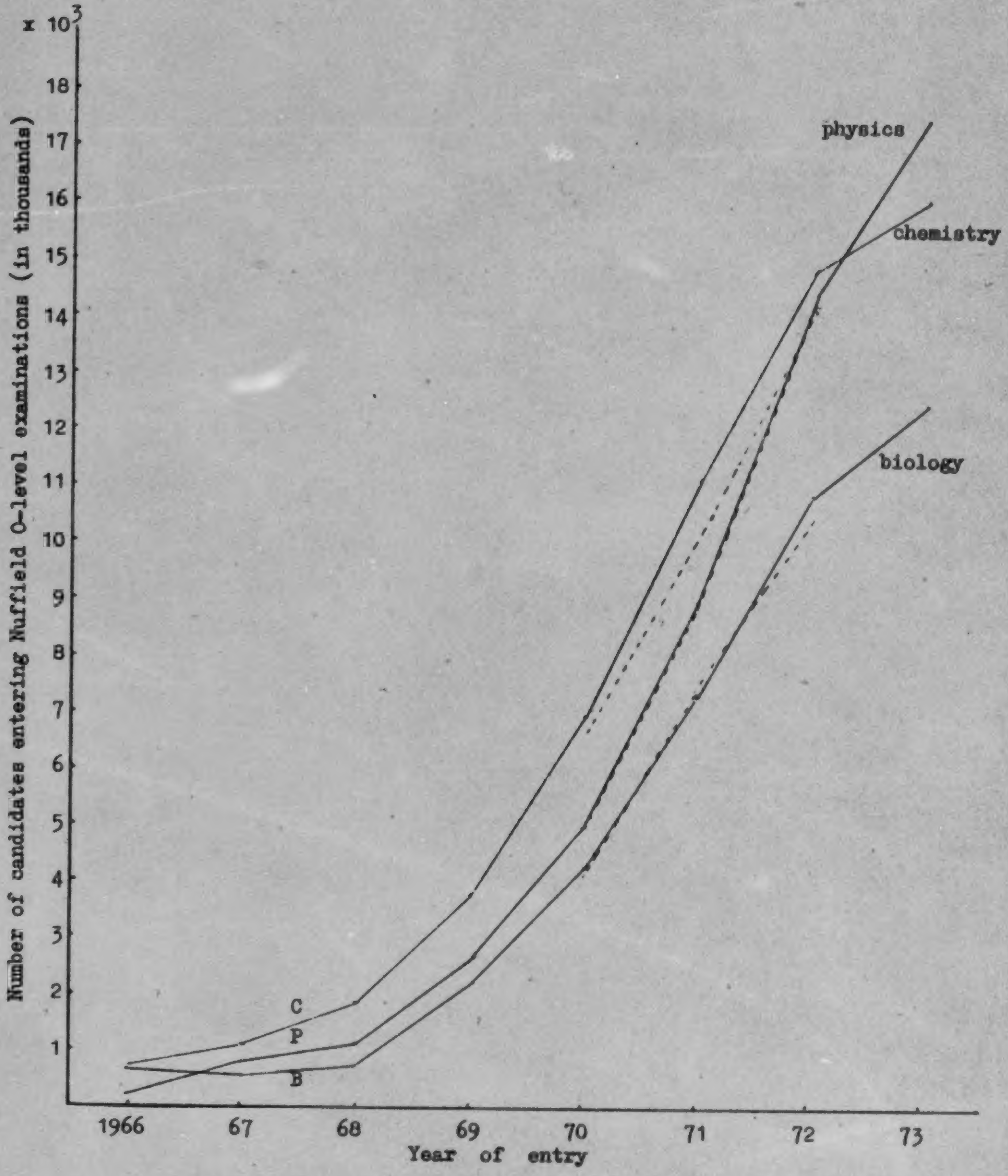
---

[1] Data showing schools entering candidates for the special Nuffield examinations, and the numbers entered from each school, were obtained from the examination boards administering the relevant examination in the spring or early summer of each year. The total number of candidates obtained from these data do not match exactly the total number of candidates sitting the examination each June. This is accounted for by withdrawals and is a considerable factor only in the case of chemistry in 1971 where the error was apparently almost 10%.

Detailed breakdown of candidates into schools was available only for the former, larger figure, therefore when numbers of candidates are discussed the totals are reduced proportionately. Where numbers of schools are discussed it is assumed that withdrawals did not affect the number of schools entering candidates.

[2] Statistics in Education, Vol. 2, 1972, HMSO.

Fig. 5.1. Use of Nuffield O-level examinations: by candidates (in England and Wales only)



——— entry figures provided in spring of each year

- - - - - - - candidates sitting examination in June (from Examination Boards' reports 1970/1/2)

Differences in the use of projects may be related to variables within the project (each was developed independently), within the community of teachers using them, or within the nature and perceived needs of the pupils using them. Possible causes of the relatively slow start for physics compared to chemistry may be suggested in the delay in publishing of the O-level physics materials (and the A-level materials), the higher cost of implementing the physics course, requiring its adoption to be staggered, or the differing geographical distribution of trial schools.

The markedly lower percentage use of the biology project suggests more extensive resistances, or those different perhaps in kind, from those operating in the case of physics and chemistry. One very obvious difference apparent from Figure 5.2 is the differential use of the three sciences for boys and girls.

## THE USE OF PROJECTS TO EXAMINATION: BY BOYS AND GIRLS

The pattern of entries for O-level science subjects in England and Wales since 1964 shows the very obvious bias of boys to the physical sciences, and especially to physics, and of girls to biology. The trends in entries over recent years show a halt or depression in growth in 1966 (the time of comment on the "swing from science") - except in biology for boys, followed by a steady increase in entries to 1972 - the last year for which figures are presently available. The similarity in the rate of growth between the three sciences and between boys and girls is remarkable and has occurred since the Nuffield O-level science projects were published. The rate of growth is most marked in the case of biology - the science apparently least influenced by the Nuffield project (from percentage use figures p.5.01) - while for boys the growth rate is least in chemistry, the Nuffield project showing greatest early percentage use. The rate of increase in entries of girls in physics and chemistry is almost equal but less than the increase in biology. This latter, however, almost exactly follows the pattern of growth in English language entries for girls, if the exceptional entry recorded in 1969 is ignored.

The inclusion of English language entries here is an attempt to display general trends in entries at O-level by boys and girls, but is not entirely satisfactory since it displays a recent fall in entries by boys not mirrored in the total examination entries[1]. However, both these indicate that steadily more girls are entering for O-level examinations, whereas no clear increase is general for boys.

Not all examining boards publish entries for the special Nuffield examination separately for boys and girls. However, these details were obtained for all but one small board for candidates in England. These were combined with numbers entering from each school to give a figure for boy and girl entries from single sex and mixed schools separately. Percentage pass rates were also obtained.

In the following analyses comparable national figures are shown, including separate science data for CSE. These latter show that the sex bias in examination work in the sciences becomes more marked with the less academically able pupils.

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1. From 1966 to 1972 total entries for O-levels for boys has changed from just below 1,160 thousand to just above 1,160 thousand, and for girls from ca 960 thousand to 1060 thousand.

Fig. 5.2. Pattern of entries for O-level in English language and science subjects for boys and girls (1964-72)

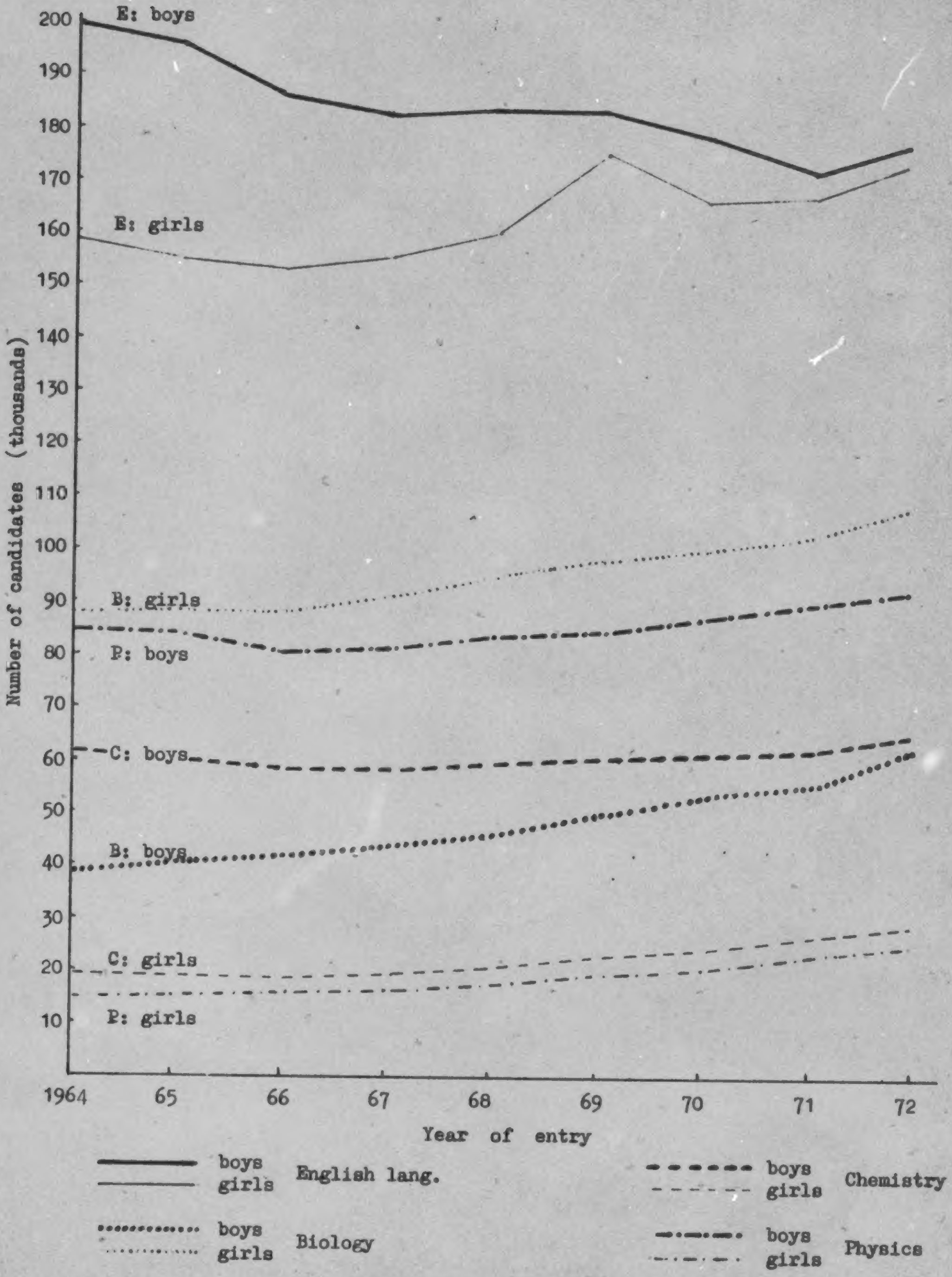

**Table 5.2. Entries and percentage pass rates for boys and girls in science**

| | Total entries | | Ratio | % Passes | |
|---|---|---|---|---|---|
| | Boys | Girls | Boys : Girls | Boys | Girls |
| **Nuffield 1972*** | | | | | |
| Biology | 4987 | 4352 | 1.1 : 1 | 70.1 | 58.2 |
| Chemistry | 8463 | 3604 | 2.4 : 1 | 69.5 | 67.6 |
| Physics | 9807 | 2304 | 4.3 : 1 | 72.1 | 63.3 |
| **National G.C.E. 1972** | | | | | |
| Biology | 61988 | 106905 | 0.6 : 1 | 61.5 | 57.3 |
| Chemistry | 64118 | 28609 | 2.2 : 1 | 61.2 | 61.9 |
| Physics | 92405 | 24420 | 3.8 : 1 | 58.6 | 61.9 |
| **National C.S.E. 1972** | | | | Grade 1 passes | |
| Biology | 23199 | 50589 | 0.4 : 1 | 15.0 | 14.9 |
| Chemistry | 27653 | 10959 | 2.5 : 1 | 14.7 | 13.2 |
| Physics | 61859 | 7291 | 8.4 : 1 | 14.7 | 11.5 |

* These figures are for five Boards only - London, Oxford, Cambridge, J.M.B. and A.E.B. Total entries for England and Wales from all Boards were Biology 10392, Chemistry 13887, Physics 13996. Percentage pass rate for the Oxford and Cambridge Board was not available but the total entries for this Board were -

| | Boys | Girls |
|---|---|---|
| Biology | 867 | 8 |
| Chemistry | 1471 | 34 |
| Physics | 1514 | 8 |

Fewer girls than boys have been entered for the Nuffield biology examination: a reversal of the national pattern. The ratios of girls to boys entering for the physics and chemistry examinations were even more biased to the boys than the national ratios in 1972. Moreover, the success rate for girls has been markedly less than for boys in both biology and physics: a pattern that has been sustained through 1970, 1971 and 1972 and which reverses the national trend in physics. Only the chemistry figures reflect the national pattern of close percentage pass rates for boys and girls, with neither consistently greater than the other.[1]

As the findings of the case-studies show[2], teachers' perception of the projects in relation to their perception of pupils' needs and abilities are important factors in decision-making in the use of projects.

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1. Significance tests show that differences in percentage pass rates for both Nuffield and national figures are significant for biology and physics but not for chemistry.

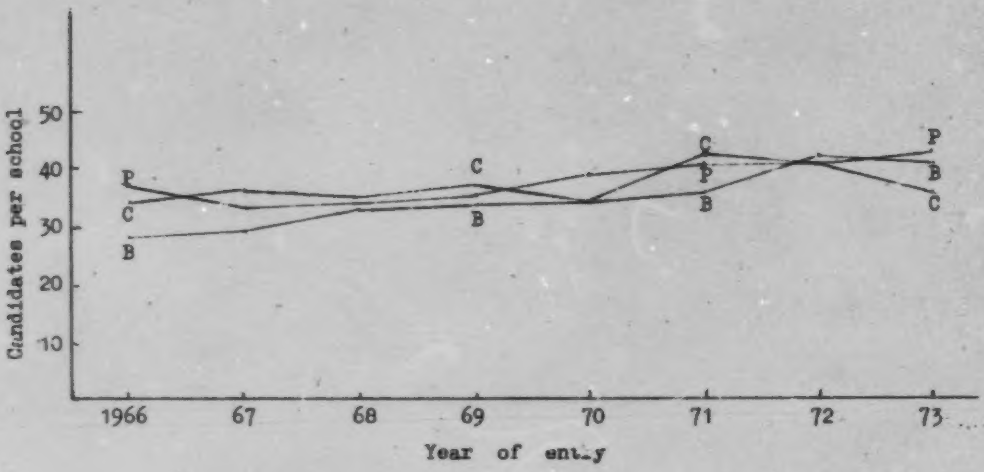
2. See Chapter 17.

## CHAPTER 6

## USE OF PROJECTS TO EXAMINATION: BY SCHOOLS

The average number of candidates per school entering for the examinations has remained relatively steady, with a slight increase shown by all three projects but most marked for biology.

Fig. 6.1. Variation in candidates per school entering for Nuffield O-level examinations



Any variation in the number of candidates per school will reflect differences in the general pattern of use by candidates and by schools. The school is perhaps a more valid unit for the measurement of full adoption than the number of candidates, since few candidates enter the examination independently. The decision to use the Nuffield examinations is also made, ultimately, at the teacher level, if not by the school as a whole (but see later a discussion of decision-making). The actual number of candidates entering for an examination will be related to the size of the school, the ability distribution in the school population, any restrictions imposed on the choice of subjects and all the other factors that influence a pupil when choice is made.

Not all schools who have entered candidates for Nuffield examinations continue to do so. Any increase in the number of schools using the projects to examination in any one year is the resultant of those who are using them for the first time and those who have stopped using them. Diffusion measured or discussed in terms of use of projects is not valid unless the extent of discontinuances is appreciated. As Table 6.1 shows, these have not been large in the past but appear to be increasing. (There is some evidence from the case studies that a discontinuance may occur as a consequence of comprehensive reorganization - for example, if a user school becomes a Sixth Form College or a Middle School.)

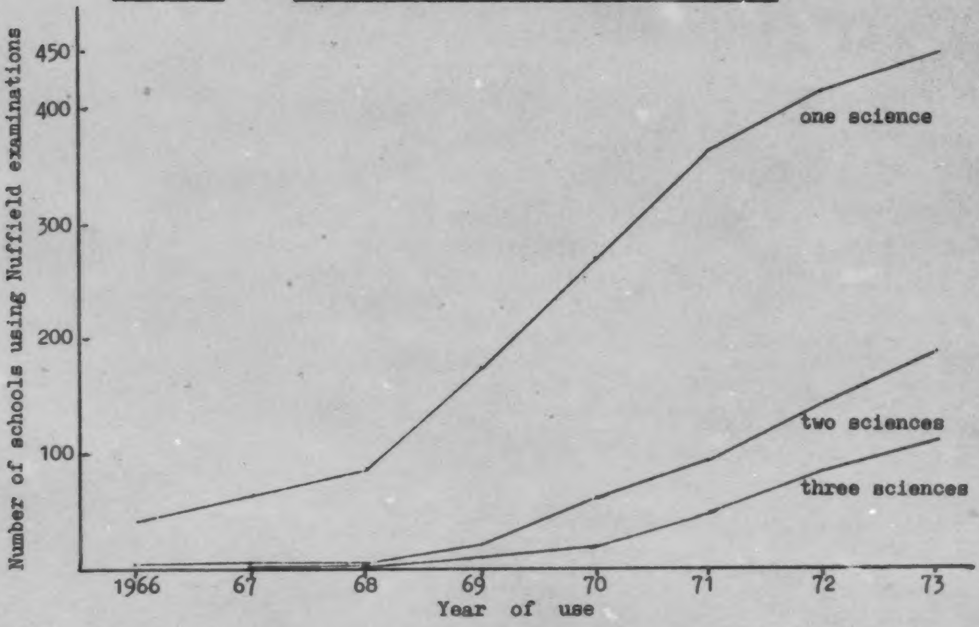
Table 6.1. **Discontinuance of Examination entries.**
The table includes schools that did not have entries in the years recorded but did the previous year. Schools are not recorded where they dropped the examination for only one year and then resumed. Figures for 1972 indicate schools which have not taken the examination since 1971 but which may well resume in 1974.

| | BIOLOGY | | | CHEMISTRY | | | PHYSICS | | |
|---|---|---|---|---|---|---|---|---|---|
| | Discontinuance | | | Discontinuance | | | Discontinuance | | |
| | Permanent | 2 yrs | 3 yrs | Permanent | 2 yrs | 3 yrs | Permanent | 2 yrs | 3 yrs |
| 1967 | 5 | 1 | 1 | 1 | | | 1 | | |
| 1968 | 1 | 1 | | 1 | | | 2 | | 1 |
| 1969 | 3 | 1 | 1 | 3 | | | 2 | 1 | |
| 1970 | 4 | | | 5 | | | 6 | | |
| 1971 | | 2 | 11 | | 3 | 7 | | | 5 |
| 1972 | | 19 | | | 19 | | | 11 | |

## DIFFERENTIAL USE OF PROJECTS BY SCHOOLS

Indications of the relative independence in decision-making of the separate sciences in schools are obtained by examining the distribution of schools in categories of those using one, two or three projects to examination. (Figure 6.2)

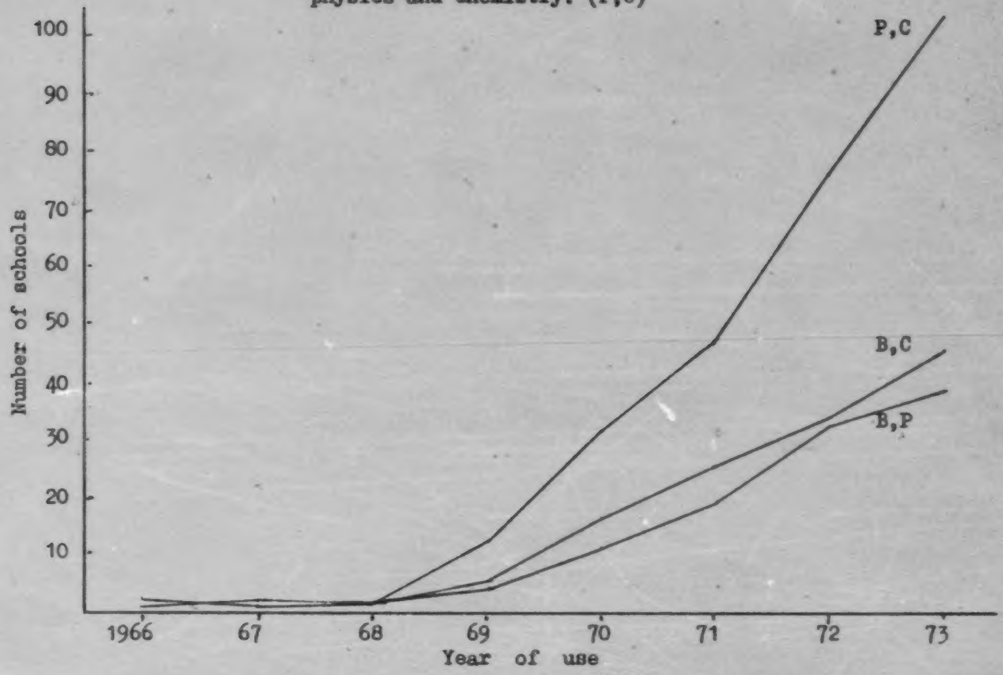
Fig. 6.2. Use of Nuffield examinations by schools



In the years 1968-71 the rate of growth of schools using one science only is considerably greater than the rate of growth of those using two sciences, which in turn is greater than the rate of growth of those using three sciences. Since 1971 the resultant rate of growth of the one science category has slowed, with a build-up in the two science category.

An analysis of the two sciences category into subjects pairing in schools (Fig. 6.3) shows a marked association between chemistry and physics, which in recent years has been more than double the association between either biology and chemistry or biology and physics.

Fig. 6.3. Use of Nuffield examinations by schools in two sciences:
biology and chemistry: (B,C)
biology and physics: (B,P)
physics and chemistry: (P,C)



## THE USE OF PROJECTS TO EXAMINATION: BY SCHOOLS OF DIFFERENT KINDS

One problem that faces a curriculum development project at the trial stage is the variety that exists in secondary school organization in England and Wales.

In 1962 the obvious patterns for organization were by support: maintained, direct grant, independent; by sex: boys, girls, mixed; by ability: grammar, secondary modern, comprehensive, and by age, with some independent schools admitting pupils only at 13+, while relatively few secondary modern schools retained pupils beyond 16+.

Ten years later these categories still exist but the distribution of schools within them may have changed dramatically. The continuance of direct grant and independent schools is under discussion. An increasing number of mixed schools is being formed from boys and girls schools, during the process of secondary reorganization, which results in an increase in the number of comprehensive schools, together with a disappearance of some grammar and secondary modern schools. Accompanying secondary reorganization also has been a change in the age range of pupils within some maintained schools, with the emergence of middle schools (8 to 12 years or 9 to 13 years), "lower" secondary schools (11 to 13 years or 11 to 14 years) linked with corresponding "upper" schools, or comprehensive schools (11 to 16 years) linked to sixth form colleges. Some of these changes are displayed in Figures 6.4 and 6.5.

Fig. 6.4. Variation in school organization: 'ability'

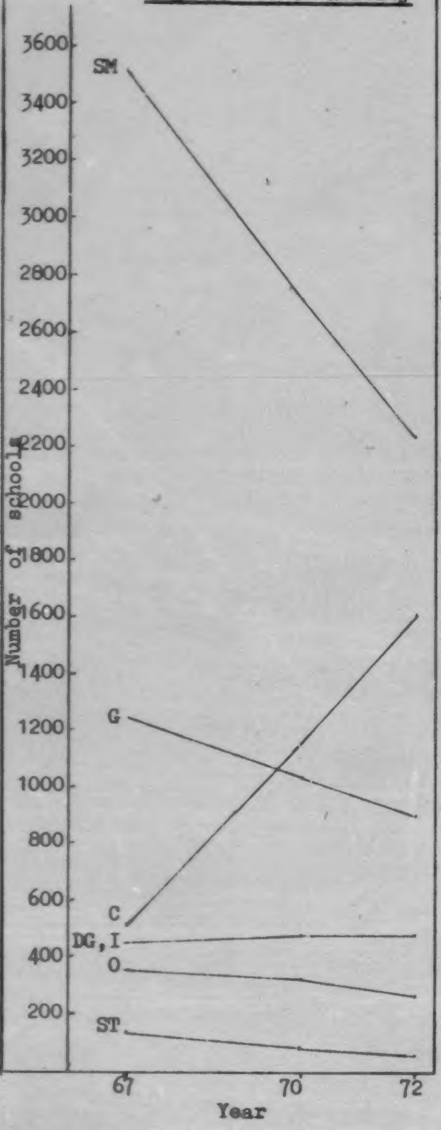
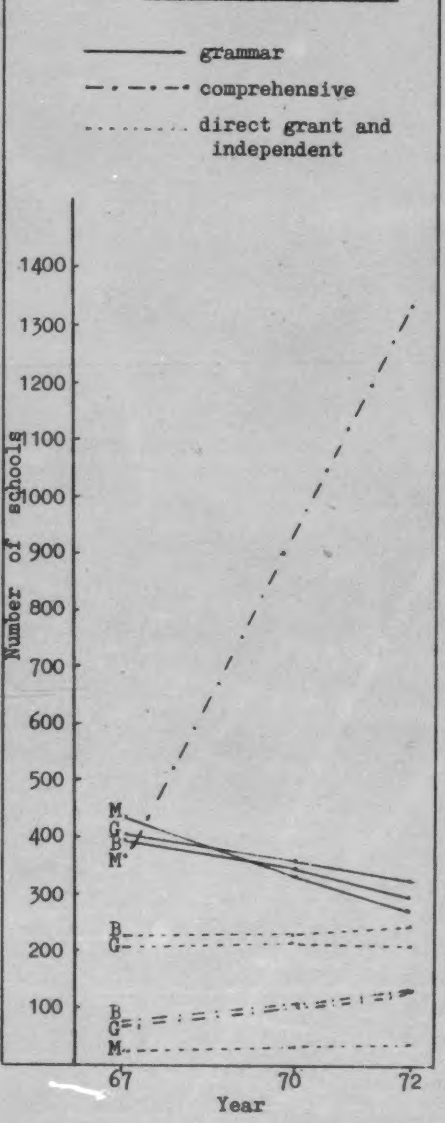


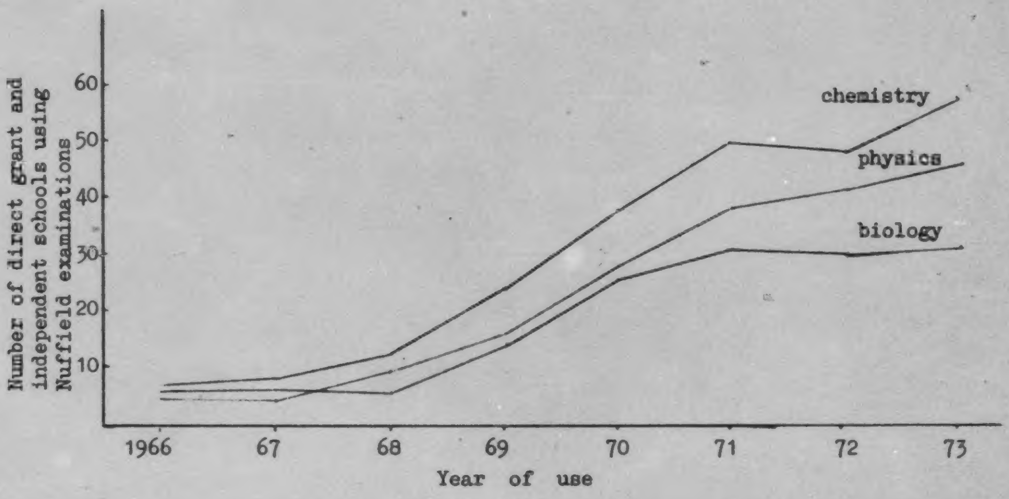
Fig. 6.5. Variation in school organization: 'sex'



Any discussion of use of the Nuffield Science projects must be seen against this background of change. The background to decision-making is different in the public and private sectors of education, so that these are considered separately. Perhaps no clear distinction existed for the project developers and certainly the proportion of direct grant and independent schools entering for the examinations from the trial stage was high, varying between 25% and 35% in 1966 and 1967. This dropped to about 5% to 15% by 1972 and 1973, no doubt reflecting the smaller number of schools in the private sector in addition to other variables.

The pattern of use by direct grant and independent schools is shown in Figure 6.6. This displays a partial saturation from 1971, apparently complete for biology.

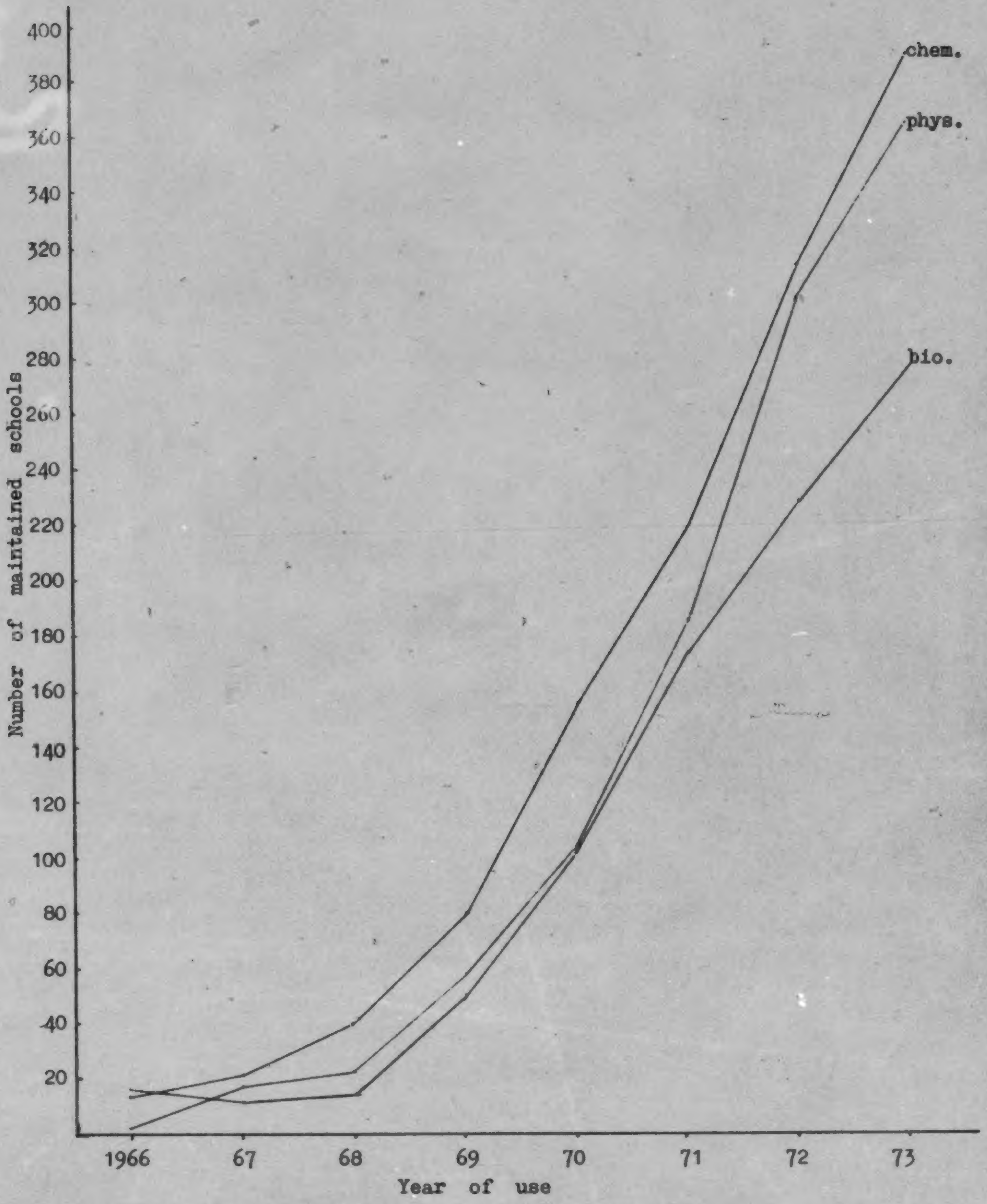
Fig. 6.6. Use of Nuffield examinations: by direct grant and independent schools.



When use by maintained schools is examined, (Fig. 6.7) 1971 emerges as the year when the patterns for physics and biology - similar until then - diverge to result in 87 more (nearly 25% more) schools using the physics project than the biology project. From this, too, chemistry appears to have maintained a steady growth rate, by schools, since 1969. This is a slightly lower rate than physics has shown since 1970.

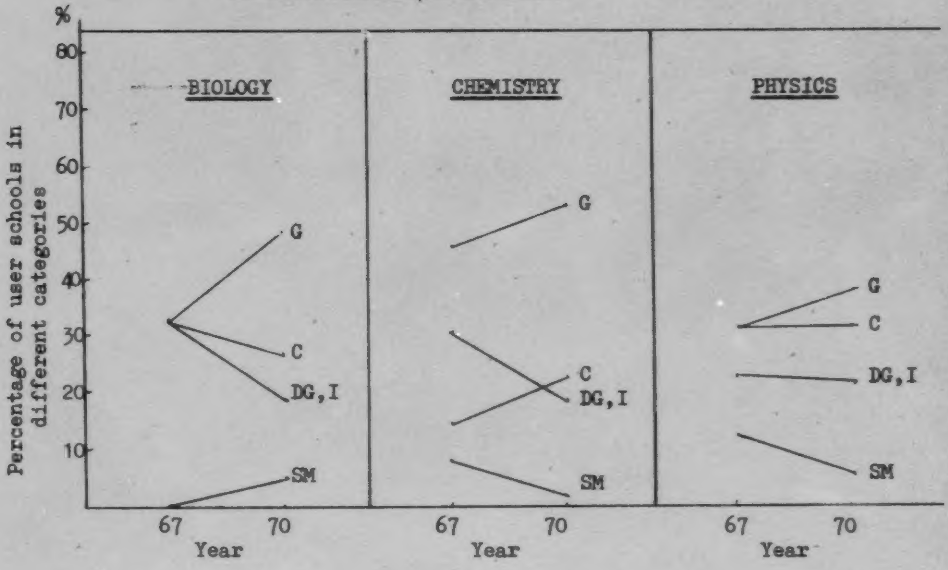
Comparison of Figures 5.1 and 6.7 suggests that the sharp fall in growth rate apparent in chemistry from 1972 to 1973 is caused by smaller groups entering for the first time in 1973 or the reduction in size of group entered by a considerable number of schools. In biology the corresponding change in growth rate appears to be caused by larger than usual groups in 1972. These changes are possibly reflections of the changing relative popularity of these subjects within the schools.

**Fig. 6.7.** Use of Nuffield O-level examinations: by maintained schools.



There was some attempt by all three O-level projects to include schools of all categories containing 16+ pupils at the trial stage. In biology no secondary modern school entered candidates for Nuffield examinations in 1966 or 1967, though parts of the materials were tried out in a few secondary modern schools. The use of the projects to examination by different categories of schools is shown (Figure 6.8)[1].

Fig. 6.8. A comparison of schools using the Nuffield O-level examinations in categories "grammar", "comprehensive", "secondary modern" and "direct grant and independent" as a percentage of all schools using the projects to examination in 1967 and 1970.



The relatively high percentage of direct grant and independent schools in the trial stage can be related to the origin of the projects.[2] This fell to around 20% for each project in 1970 and further to 10% in biology, 14% in chemistry and 12% in physics in 1973 as use of the projects spread through the larger maintained system.

Secondary modern schools have remained low users of the projects to examinations, as might be expected, and in later parts of the study have been excluded from discussions that use O-level examinations as measures of use.

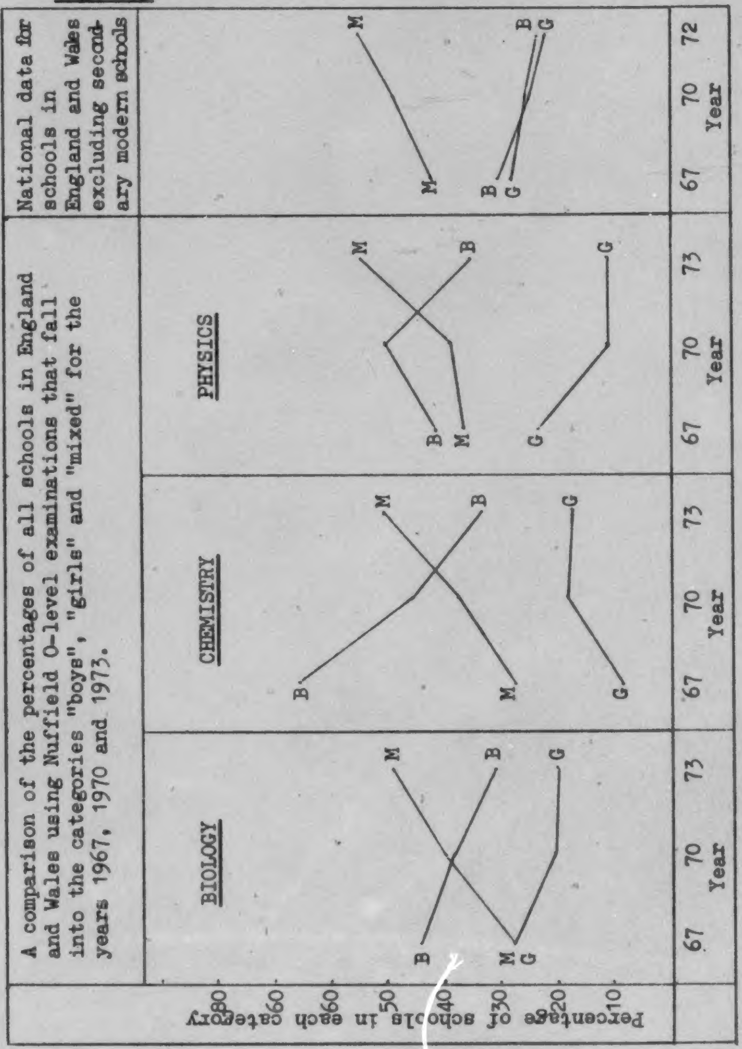
---

1. No attempt has been made to categorize schools using the project in 1973 since LEAs are increasingly describing 11+ schools merely as "secondary" in published statistics.

2. See Waring (1975).

A study of Figure 6.8 shows that in 1970 the projects were seen as more usable in grammar than in comprehensive schools, though this is less marked in physics. The lower use in comprehensive schools may be related to their more frequent development out of secondary modern schools than from grammar schools that Figure 6.4 suggests. This is supported by responses from head teachers[1], where 32% of the responding schools had changed from secondary modern to comprehensive, and less than one third of these had earlier been grammar schools.

Fig. 6.9.



A comparison of the percentages of all schools in England and Wales using Nuffield O-level examinations that fall into the categories "boys", "girls" and "mixed" for the years 1967, 1970 and 1973.

National data for schools in England and Wales excluding secondary modern schools

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[1] Questionnaire Survey. 8% National sample.

When use by girls, boys and mixed schools is analyzed (Figure 6.9) it can be seen that while chemistry included only 8% of girls schools to examination at the trial stage, the percentage of girls schools in biology and physics was greater: 29% and 26% respectively. However, after only three years the pattern had changed to around 20% for both biology and chemistry and a mere 11% in physics, suggesting that the composition of the trial schools by sex type has little influence on later use by these categories. This is further supported in the pattern of use by boys and mixed schools in chemistry and physics, which started with very different relative numbers in these two categories but in which the 1970 and 1973 percentage uses are very similar.

If the data excluding secondary modern schools is used as a reference, it is apparent that in 1973 all three projects to examination were used relatively more frequently in boys schools than in either mixed or girls schools, both of which showed percentage uses lower than their percentage incidence nationally. This is most marked for girls schools in the physics project and it is only in physics, therefore, that potentially a girl has more chance of following a Nuffield course in science if she attends a mixed school rather than a girls school.

Various possible causes may be suggested to account for the differential use by schools of different sex type:

- school organization, including options available in science subjects, may differ,
- facilities for science may be better generally in boys schools,
- science teachers in boys schools may differ from those in girls and mixed schools,
- present mixed schools have undergone more change than boys and girls schools since 1966,
- the type of learning embodied in the Nuffield science projects may be seen as more suitable for boys than for girls, etc.

## Boy and girl entries per school

It was noted earlier that it was only in physics that a girl might be more likely to follow a Nuffield science course to examination if she attended a mixed school and not a girls' school, since it was slightly more probable that a mixed school would use a Nuffield physics course. It is interesting therefore to examine the boy and girl entries to the examinations in terms of the schools from which they come.

Table 6.2. Single sex and mixed schools: number of schools entering candidates for Nuffield O-level science examinations and average candidates per school. (1972)

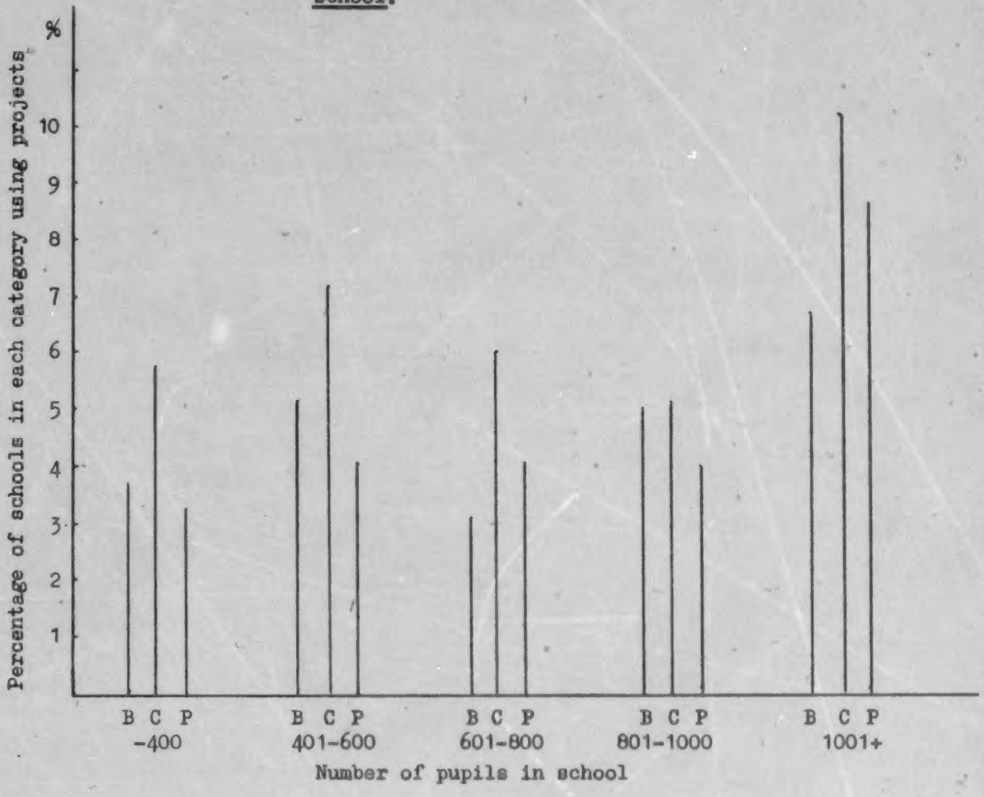
| | Single sex schools | | Mixed schools | |
|---|---|---|---|---|
| | No. schools | Entries per school | No. schools | Entries per school |
| BIOLOGY | | | | |
| Girls | 42 | 45 | 119 | 21 |
| Boys | 83 | 45 | | 18 |
| CHEMISTRY | | | | |
| Girls | 58 | 30 | 162 | 12 |
| Boys | 121 | 46 | | 27 |
| PHYSICS | | | | |
| Girls | 36 | 21 | 163 | 9 |
| Boys | 119 | 54 | | 30 |

This analysis shows that in the single sex schools that enter for the Nuffield biology examination the number of boy candidates per school is equal to that of the girls schools, while in chemistry, and even more in physics, the average number of girls entering per school is considerably less than for the boys schools. In mixed schools the figures suggest that the sex bias is operating on the entries, depressing the boy entries in biology and depressing the girl entries even further in chemistry and physics. There are no statistics readily available to test if this is a characteristic of O-level science entries in general.

## Size of school

The pattern for 1970 indicates that size of school has little differential effect on the use of Nuffield science projects except for the large school of over one thousand pupils which is more likely to use the projects than is indicated by its occurrence nationally, whereas the small school of less than 400 pupils is less likely to be a user than its frequency suggests.

Fig. 6.10. Variation of percentage of schools in England and Wales (excluding secondary modern) using Nuffield O-level projects to examination in 1970 with size of school.



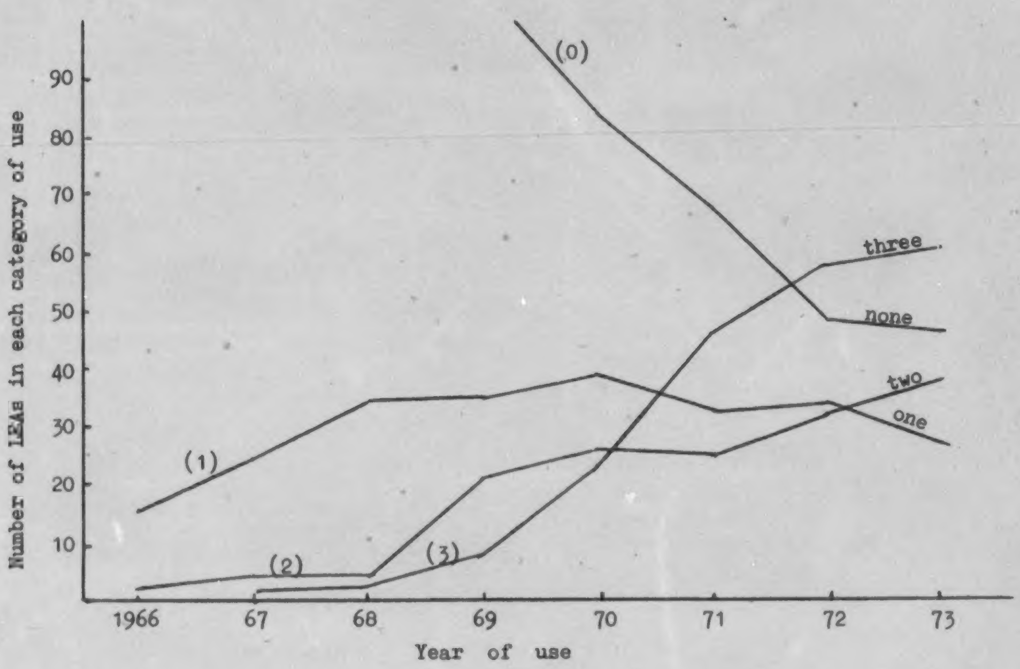
## CHAPTER 7

## THE USE OF PROJECTS TO EXAMINATION: BY LEAS

When an analysis of the use of projects within LEAs is made it is apparent that most of the areas involved at the trial stage were concerned with one of the three sciences only. From 1969 to 1972 it appears that the rate at which the LEAs became "users" of all three projects is roughly the same as the rate at which other LEAs became "users" for the first time (the positive slope of the three-projects line is equal to the negative slope of zero-projects line). The population numbers of the one-project group remained relatively constant during this period, while the two-projects group showed a slight increase in numbers. The pattern certainly displays the initial independent diffusion of each project and suggests the influence of key persons on the development of a specific project in an area.

The change in slope of the lines from 1972 to 1973 suggests a move through from the use of one project to two projects, with fewer taking up a project for the first time. A "hard core" of non-adopters may therefore have been identified by 1973.

Fig. 7.1. Use of Nuffield examination courses: by LEA



(0) Curve of non-adoption of projects
(1) Curve of use of one project
(2) Curve of use of two projects
(3) Curve of use of three projects

# THE USE OF PROJECTS TO EXAMINATION: BY LEAS OF DIFFERENT KINDS.

## I EARLY ADOPTION

An examination of Figures 5.1 and 6.3 (the use of projects to examination by candidates and by schools) shows that the use of projects increased in general after 1970. If the lower parts of the curves are assumed to display the S-shape of classical adoption studies, then the departments entering candidates for examination by 1970 were the trial schools and the early adopters (the "innovators" of some studies).

It was decided, therefore, to use the 1970 entries data to form a criterion for early adoption and to examine the characteristics of local education authorities within three categories of use as follows

### Adoption categories for LEAs in 1970

- high early adopters: those LEAs within which 4 or more departments(1), in addition to trial school groups, entered candidates for the examinations in 1970
- low early adopters: those LEAs within which 1-3 departments entered candidates in 1970
- non-adopters: those LEAs within which no department entered candidates for any Nuffield O-level examination in 1970.

### Differentiating characteristics

The characteristics for which data were available were the nature of the authority (whether a county, a county borough, a London borough, etc.), the size of the authority, the product of a 1d rate, secondary school organization, the number of trial schools (both maintained and direct grant and independent schools) occurring within the LEA area, and a list of LEA delegates attending a conference organized specifically for them at Easter 1967 and to which all LEAs had been invited to send delegates.

### Classification of LEAs into size categories

Three criteria of size were considered:

i. the total population

ii. the secondary school population

iii. the number of secondary schools

Some measure of the LEAs commitment to secondary schools was required. (i) was ruled out as the secondary school population varied from 4% to over 12% of the total population. (iii) was attractive as it reflected the number of institutions to which the LEA was committed, but as the size of schools was so variable in different LEAs this was eventually replaced by (ii), the secondary school population.

---

1. Separate biology, chemistry and physics departments were summed individually to arrive at a total number of departments.

Seven categories of size were created, the smaller categories varying by intervals of 5,000 pupils, with greater variation in the two largest categories as shown.

Table 7.1. Size categories of LEAs

| Size category | Secondary school population intervals | No. | Condensed categories |
|---|---|---|---|
| VS | 5,000 and under | 26 | 76: small |
| S | 5,001 to 10,000 | 50 | |
| SM | 10,001 to 15,000 | 28 | 45: medium |
| M | 15,001 to 20,000 | 17 | |
| ML | 20,001 to 25,000 | 12 | 42 large |
| L | 25,001 to 35,000 | 12 | |
| VL | over 35,000 | 18 | |
| | | 163 | |

The product of 1d rate

The figures were taken from statistics published for 1968/69[1] and were modified to show the product of the penny rate per secondary school child. This was thought to represent the availability of finance for secondary schooling with more comparative validity than the raw figures. Three categories were formed from the processed data as follows:

Table 7.2. Rates Product Categories of LEAs

| Category | Penny rate produce per secondary school child[2] | No. |
|---|---|---|
| High | £3.5 + | 40 |
| Medium | £2.5 - £3.4 | 55 |
| Low | less than £2.5 | 65 |
| | Total | 160[3] |

---

1. Education Committees Year Book 1968/69
2. The range of values was from £1.1 to £5.4.
3. Data for 3 missing

## Secondary school organization.

The diffusion period for the Nuffield O-level projects from 1966 has been a period of reorganization of secondary schooling, the overall progress of which can be seen in Figure 6.6 (variation in school organization: "ability"). The LEAs were classified into three categories of reorganization[1]

(a) LEAs with less than $\frac{1}{3}$ of secondary schools described as comprehensive,

(b) LEAs with between $\frac{1}{3}$ and $\frac{2}{3}$ of secondary schools described as comprehensive,

(c) LEAs with more than $\frac{2}{3}$ of schools described as comprehensive

## Identification of trial schools

At a time six years distant from the end of the trials several sources were available from which it was theoretically possible to identify trial schools.

(1) Lists of persons and schools represented at the Loughborough Briefing Conferences in 1964. Only one such complete list had survived and it was known that not all the schools represented had gone on to try out materials.

(2) The published materials of each project contained acknowledgements to:

"Schools which have participated in trials or helped in other ways" - Biology

"Schools which took part in the trials" - Chemistry

"Schools collaborating in the trials" - Physics.

In each project schools were named which had not, for some reason, used the trial materials to any appreciable extent with pupils, but it was not possible to identify all such schools.

(3) Examination entries showed the year in which schools first entered candidates for the special Nuffield examinations in each project. Entries in early years were almost certain to have come from trial schools only.

A decision was made to designate schools entering candidates in 1966 and 1967 as trial schools for the purposes of the project, but as work developed it became apparent that this criterion for trial school identification had led to the exclusion of schools which had tried out materials for Years 1 and 2 of the projects in the 1964-5 trials. These schools had most probably progressed on to the later years of the materials and would have entered candidates for the examinations only in 1968 or 1969.

When an analysis of the examination entry behaviour of the schools mentioned by name in the texts was carried out, the following patterns emerged:

---

[1] Using data from 1968/69 Education Committees Year Book

## Biology

| | | |
|---|---|---|
| Total number of schools mentioned | = | 88 |
| Schools in Scotland | | 8 |
| Schools entering candidates 1966/7 | | 27 |
| Schools entering candidates after 1967 | | 10 |
| Schools never entering candidates | | 43 |
| | | 88 |

## Chemistry

| | | |
|---|---|---|
| Total number of schools mentioned | = | 84 |
| Schools in Scotland and Eire | | 6 |
| Schools entering candidates 1966/7 | | 26 |
| Schools entering candidates after 1967 | | 16 |
| Schools never entering candidates | | 36 |
| | | 84 |

## Physics

| | | |
|---|---|---|
| Total number of schools mentioned | = | 49 |
| Schools entering candidates 1966/7 | | 22 |
| Schools entering candidates after 1967 | | 17 |
| Schools never entering candidates | | 10 |
| | | 49 |

It was decided, therefore, to class as trial schools all those schools entering candidates in 1966 and 1967 together with those mentioned in the texts as contributing to trials and who had entered groups of candidates in more than one year in the interval 1968-70.

## 1967 Easter Conference

A conference was organized by The Nuffield Foundation at Easter 1967 expressly to make the O-level projects more widely known to Local Education Authorities and those responsible for teacher training. A list of delegates to this conference was found in one of the few files to survive from the projects' organizers after two housing moves. It contained the list of delegates, together with their sponsor LEA and a school, college, home or an education office address. It was assumed that the administrators would give an education office address, while those giving a home address would more likely be teachers. This assumption may not be valid and was known in one case to be false, so that the resulting number of administrators may be low.

## Characteristics of LEAs and level of adoption in 1970

The analysis of the three 1970 adoption groups of LEAs into the groups formed from the characteristics discussed above is shown below in Table 7.3.

Table 7.3. 1970 Adoption by LEAs

| | | Early High Adopters N = 23 | | Adopters N = 62 | | Non-adopters N = 78 | |
|---|---|---|---|---|---|---|---|
| Characteristics | | N | % of N | N | % of N | N | % of N |
| (i) LEA type | County | 17 | 74 | 19 | 31 | 19 | 24 |
| | County borough | 4 | 17 | 31 | 50 | 49 | 79 |
| | London borough | 1 | 4 | 12 | 19 | 7 | 9 |
| (ii) Size ("condensed" categories) | Large | 21 | 91 | 16 | 26 | 5 | 6 |
| | Medium | 2 | 9 | 22 | 35 | 21 | 27 |
| | Small | 0 | 0 | 24 | 39 | 52 | 66 |
| (iii) 1d rate | high | 5 | 22 | 21 | 34 | 14 | 18 |
| | medium | 9 | 39 | 23 | 37 | 33 | 42 |
| | low | 7 | 30 | 18 | 29 | 38 | 49 |
| (iv) Comprehensive reorganization: | less than ⅓ | 21 | 91 | 45 | 73 | 47 | 60 |
| | more than ⅔ | 2 | 9 | 13 | 21 | 26 | 33 |
| (v) Trial schools | total | 17 | 74 | 27 | 44 | 5 | 6 |
| | maintained schools | 14 | 61 | 21 | 34 | 1 | 1 |
| (vi) LEAs sending delegates to 1967 Conference | | 21 | 91 | 32 | 52 | 24 | 31 |
| LEAs sending administrator to 1967 Conference | | 13 | 57 | 11 | 18 | 8 | 10 |

When percentage figures are compared across the three adoption categories it is clear that all characteristics except the product of 1d rate per secondary school child correlate, to some extent, with use of projects by LEAs.

For the first two and last two characteristics it could be that all we are detecting is the effect of size.

If the use of projects was randomly distributed there would be a greater probability that the large authority would have within it trial schools and other schools using projects by 1970, (assuming random diffusion also). The large authority was, before 1974, more likely to be a county authority and to employ a large enough team of administrators to send one of them to represent it at a conference.

The pattern of comprehensive reorganization shows the high adopters (the large, mostly county authorities) as relatively unaffected by reorganization, while a third of the non-adopters were well on the way to complete reorganization into comprehensive schools. One may argue that a system retaining grammar schools was more likely to use the O-level projects as they were relevant for all the pupils in these schools, while one with a number of newly-created comprehensive schools would be more concerned with educational tasks focussing on the average and below average pupils.

In addition, as Shipman discovered with the Keele Integrated Studies Project[1], a system undergoing a large scale reorganization would be less aware of, or committed to, other innovations.

A constellation of factors emerged from this study of early adoption: an early adopter was likely to be a large county authority, not committed to comprehensive reorganization, in which at least one trial school had been sited, and which had acquired further information about the projects in 1967. To examine the continuing effects of these factors on use of projects the high adopters of 1973 were identified, but in terms of percentage adoption to eliminate the probability effect of size.

## II ADOPTION IN 1973

To arrive at a figure for percentage adoption it was necessary to know the number of schools in an LEA that could be expected to use the Nuffield O-level projects. It was assumed that secondary modern schools did not fit this criterion, even though it was known that a few secondary modern schools were using the projects.

The "possible" schools[2] were totalled for each LEA - it was assumed each school was potentially able to enter pupils for O-level in all three sciences. Then

$$\text{percentage use} = \frac{\text{No. of groups entering Nuffield examinations} \times 100}{\text{No. of "possible" schools} \times 3}$$

The degree of reorganization into comprehensive secondary schools was obtained from the same D.E.S. statistics as follows -

$$\text{reorganization factor} = \frac{\text{No. "possible" schools}}{\text{Total No. Secondary schools}}$$

For an LEA not already embarked on reorganization, this factor would be of the order of 20% - 30%, for those fully reorganized the factor would be 100%.

The LEAs were classified into three groups -

(i) with reorganization factor less than 33.3%
(ii) with reorganization factor between 33.3% and 66.7%
(iii) with reorganization factor 66.7% or greater.

---

[1] See Shipman (1973)

[2] Grammar, comprehensive and secondary technical schools were identified from DES statistics for 1971.

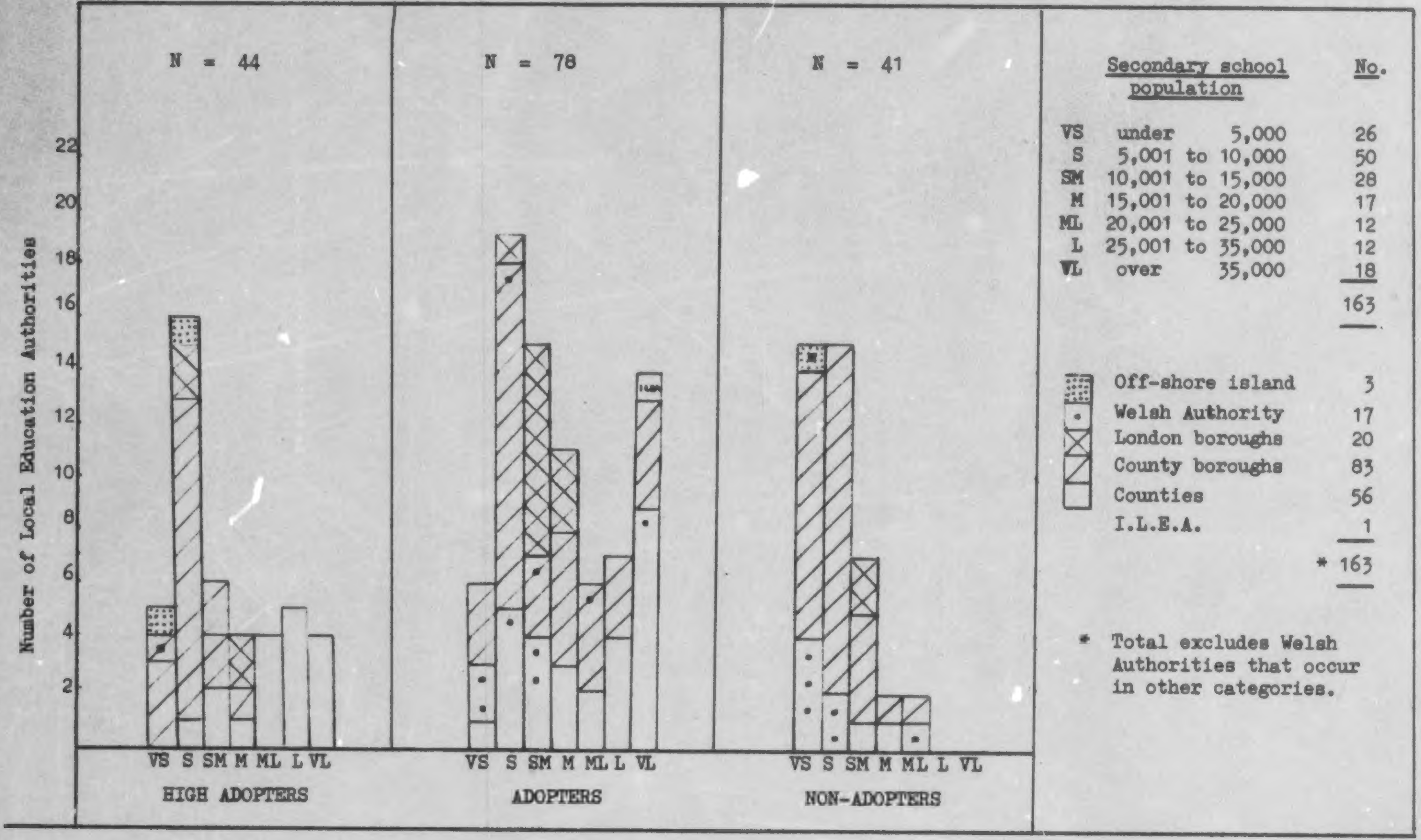
The size and 1d rate data were those used before. Although changes may have occurred in these it was assumed that they were not great enough to render the analysis invalid.

When the analysis of characteristics and level of adoption is examined (Table 7.4) it can be seen that LEA type and size have no longer a regular association with level of use of projects: the county boroughs, for example, forming the largest percentage within each category, and the small LEA forming the largest percentage of both high and non-adopters. However, the county boroughs and the small LEAs form nearly three-quarters of the non-adopter category. These groups are likely to contain many common LEAs, as county boroughs are often small. A more detailed analysis of size and type of authority is shown in Figure 7.2 (histogram).

Table 7.4. Characteristics of LEAs and level of adoption in 1973

| | | High Adopter N = 44 | | Adopters N = 78 | | Non-adopters N = 41 | |
|---|---|---|---|---|---|---|---|
| Characteristics | | N′ | % of N | N′ | % of N | N′ | % of N |
| (i) LEA type | County | 17 | 39 | 30 | 38 | 10 | 24 |
| | County borough | 19 | 43 | 35 | 45 | 29 | 71 |
| | London borough | 6 | 14 | 12 | 15 | 2 | 5 |
| (ii) Size | Large | 13 | 30 | 27 | 35 | 2 | 5 |
| | Medium | 10 | 23 | 26 | 33 | 9 | 22 |
| | Small | 21 | 48 | 25 | 32 | 30 | 73 |
| (iii) 1d rate | High | 16 | 36 | 18 | 23 | 6 | 15 |
| | Medium | 17 | 39 | 24 | 30 | 14 | 34 |
| | Low | 11 | 25 | 34 | 44 | 19 | 46 |
| (iv) Comprehensive reorganization: | less than ⅓ | 15 | 34 | 12 | 15 | 10 | 24 |
| | more than ⅔ | 10 | 23 | 31 | 40 | 17 | 41 |
| (v) Trial schools | (all schools) | 21 | 48 | 24 | 30 | 4 | 10 |
| | maintained schools | 19 | 43 | 19 | 25 | 1 | 2 |
| (vi) LEAs with Science Advisers in 1973 | | 18 | 40 | 32 | 41 | 8 | 20 |

Fig. 7.2. Distribution of LEAs when variables considered are percentage uptake of Nuffield O-level courses in 1973, type and size.



| | Secondary school population | No. |
|---|---|---|
| VS | under 5,000 | 26 |
| S | 5,001 to 10,000 | 50 |
| SM | 10,001 to 15,000 | 28 |
| M | 15,001 to 20,000 | 17 |
| ML | 20,001 to 25,000 | 12 |
| L | 25,001 to 35,000 | 12 |
| VL | over 35,000 | 18 |
| | | 163 |

| | | |
|---|---|---|
| ▦ | Off-shore island | 3 |
| • | Welsh Authority | 17 |
| ⊠ | London boroughs | 20 |
| ▨ | County boroughs | 83 |
| ☐ | Counties | 56 |
| | I.L.E.A. | 1 |
| | | * 163 |

* Total excludes Welsh Authorities that occur in other categories.

Examination of Fig. 7.2 shows the following patterns in 1973:

no large or very large LEA was a non-adopter;

only one English county of larger size than SM (more than 15,000 secondary pupils) was a non-adopter, while 25% of English counties of this size were high adopters;

only one Welsh authority was a high adopter;

more than one third of Welsh authorities were non-adopters (most of these being small or very small);

more than half of the very small LEAs were non-adopters;

no county borough in a "large" category was a high adopter;

county boroughs in the small category were evenly distributed through the adopter categories;

most London boroughs[1] were of medium size and clustered in the adopter category.

One may conclude that size and nature of the LEA, taken together, do influence the level of adoption of Nuffield O-level projects, with the larger authority, particularly the county authority, tending to high adoption. It is possible that problems occurring within the large urban authority (high teacher-turnover, disadvantaged pupils) depress the use of O-level projects. The very small authority is likely to be a non-adopter, but in the small LEA some factor other than size operates. It may be of optimum size to allow the influence of a key person to operate.

On the other hand several of the high-adopting, small boroughs had retained grammar schools through to 1971 and Table 7.4 indicates that there is still a negative association between degree of reorganization and level of adoption.

The product of 1d rate per secondary school child appears to operate in non-adoption, but not clearly in high adoption, while the presence of a trial school is still positively associated with level of adoption.

In general, then, the LEA provides a context which appears to influence, but not to determine, the adopting behaviour of its schools, when the Nuffield O-level projects are considered.

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[1] It is of interest here that most London boroughs fall in the high or medium categories of 1d rate product.

## CHAPTER 8

## POST-PUBLICATION DISSEMINATION THROUGH IN-SERVICE COURSES

One important factor that mediates between published curriculum materials and their use in schools is the in-service education of teachers. Formal dissemination of the Nuffield O-level projects began with the Schools Council's[1] memo to Local Education Authorities in the Spring of 1965. This memo was also published, at the request of the Council, in the November 1965, Bulletin 15, of the A.S.E., so that responsibility for in-service courses was passed firmly to the Local Authorities and science teachers were made aware of this. The Schools Council suggested the association of LEAs into thirty-three groups for the purpose of running courses in the summer of 1966. The Council offered help with programme planning and the names of possible course leaders, if these were not available locally.

Authorities were invited to support delegates at the six Conferences held in January 1966 to train extra leaders for courses in the summer. Unfortunately the delegate list for only one of these survives - the Portsmouth Biology Conference - so that no judgement on LEA response to this invitation is possible.

Local Authorities were asked to let the Schools Council know of courses planned, but no record remains except the list informing publishers of centres to which materials should be sent. Since some courses were marked as requiring no materials it is assumed that it is a complete list of courses reported to the Council.

The dispersion of courses geographically, within DES regions[2] is shown in Table 8.1. The number of LEAs in each region varies from 8 to 24. The number of LEA courses run per LEA is therefore calculated. This does not, of course, take into account the variation in size of LEAs.

Table 8.1 In-service courses held in the summer of 1966

| DES regions | Biology | Chemistry | Physics | Total | Courses per LEA |
|---|---|---|---|---|---|
| North | 2 | 2 | 2 | 6 | .43 |
| Yorkshire East and West[2] | 3 | 3 | 3 | 9 | .69 |
| North West | 0 | 0 | 0 | 0 | .00 |
| East Midlands[2] | 1 | 2 | 3 | 6 | .43 |
| West Midlands | 3 | 3 | 2 | 8 | .50 |
| East Anglia | 1 | 1 | 2 | 4 | .50 |
| Greater London | 5 | 5 | 5 | 15 | .71 |
| Other S.E. (Home Counties) | 3 | 4 | 3 | 10 | .43 |
| South West | 3 | 3 | 2 | 8 | .61 |
| Wales | 1 | 2 | 0 | 3 | .18 |
| Northern Ireland | 0 | 1 | 0 | 1 | |
| | 22 | 26 | 22 | 70 | |

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1. The recently-created Schools Council assumed responsibility from the Nuffield Co-ordination team for liaison with the LEAs.

2. A slight modification has been made to the Yorkshire and East Midlands Regions by removing Lincolnshire (Lindsey) from the Yorkshire and Humberside Region and placing it in the Midland Region together with the rest of Lincolnshire.)

Thirty-three centres were named on the list: these did not coincide with the groups referred to above and apparently not all were offering courses in all three sciences. Further geographical analysis shows that eighteen areas (possibly some of the original Nuffield groupings) covered all three sciences. In three areas not all courses were held in the same Local Authority. One large urban centre duplicated all three courses while within another area an additional course in physics was offered. Three areas provided courses in biology and chemistry only - one of these duplicating chemistry - while in another area chemistry and physics were offered, with an adjoining area offering physics. Two centres provided chemistry courses only, with no apparent link with other centres.

A total of seventy courses supported by LEAs took place in the summer of 1966 for between two and three thousand teachers.

The programme of subsequent in-service courses in local areas then depended on local initiative. This could arise from the Local Authority itself, prompted perhaps by interested teachers, from the Area Training Organization, or from other Departments or Colleges of Education.[1] In some areas extensive provision of courses was made, although it is not clear whether application for, or allocation of, places was restricted in any way other than by teacher-response.

It is worth noting perhaps that in the two cases where an individual authority, within a group, assumed responsibility for the 1966 summer course in one subject only, the pattern of early up-take of courses to examination reflects this to some extent. (Table 8.2)

Table 8.2. Comparison of course location and O-level use in LEA

| AUTHORITY | Course | | | Groups entering for Nuffield O-level examination | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | in 1966 | | | in 1970 | | | in 1973 | | |
| | B | C | P | B | C | P | B | C | P |
| P | ✓ | | | | 1 | | | 1 | 7 |
| Q | | ✓ | | | 3 (2) | (1) | 2 | 3 (2) | 1 (1) |
| R | | | ✓ | 3 (1) | 3 (2) | $\underline{4}$ (1) | $\underline{4}$ (2) | 8 (3) | 12 (1) |
| X | ✓ | | | 2 | | | 1 | 1 | 1 |
| Y | | ✓ | | 1 | 1 (1) | $\underline{2}$ | 1 | 2 (1) | $\underline{4}$ (1) |
| Z | | | ✓ | | | 2 | 1 | 4 | 3 |

(The bar drawn below a figure indicates the LEA area contained a trial school in that subject. Figures in brackets = D.G. and I. )

It is possible that within an authority there was already a bias of interest or expertise in a particular science, which prompted the choice or allocation of that science when course organization was under discussion in the group of authorities. This science would then be a focus of "Nuffield" activity in that authority. This has obviously not occurred in Authority P -

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[1] Further enquiries in LEAs (A) and (C) (see Case Studies) revealed that the Schools of Education in both had run courses in Nuffield O-level sciences in 1966.

a small borough linked with two counties. P provided an early in-service course in biology, but more than half of all secondary schools were using the Nuffield Physics project to examination in 1973, while none were using the Biology project to examination. Alternative factors must be sought to account for the very much more extensive use of one project over the others.

The behaviour within Authority Y in the second group again cannot be linked to the location of early courses. This authority was responsible for the chemistry in-service programme for the three authorities, but it had also provided a trial school for the Physics project. It is possible that this accounts for the greater use by maintained schools of the Physics project.

The apparent absence of in-service courses in the N.W. Region in 1966 was intriguing and it was decided to enquire further in this area as a test of the completeness of the data available from the publisher's list. Each LEA in the N.W. Region was therefore asked if it had any record of courses held in connection with the Nuffield Science Teaching Project between 1966 and 1968. The two counties replied, giving, in one case, information of one 11-session course held in the spring of 1968, and in the other details of the build-up of courses from day conferences.

The two large county boroughs reported that no records had been kept, but some programme of dissemination had taken place. Of the eighteen smaller boroughs only six replied, two to report no courses held, one to apologize for not having the staff to search records, one to report the appointment of a teacher adviser in 1968 to supervise the implementation of the projects in the area, while two gave useful details of the courses to which they had sent local head teachers and teachers. Further information was obtained from the institutions mentioned by these authorities so that it was possible to piece together some picture of the local provision of courses.

It seems that no local authority in the North West assumed the responsibility of running and staffing early courses in Nuffield science, but relied on existing arrangements with the two University Centres and local Colleges of Education to provide in-service training. This apparently took the form of several one day meetings at various centres covering all three sciences in the early autumn of 1966, followed by "more detailed training" at the end of the year. Weekly evening meetings covering the Physics and Chemistry projects were held in one University Centre, while in the other Centre all three projects were covered. Week-long courses or their equivalent were held in the spring of 1967 at three Centres.

In Table 8.3 the analysis of use of projects to examination by regions is displayed alongside the provision of 1966 courses per LEA.

Table 8.3. The use of Nuffield O-level sciences to Examination by Regions, 1973.

| Region | High adopters | | | | Adopters | | | | Non-adopters | | | | Total LEAs 100% | 1966 Courses per LEA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Co. | Bor. | Total | % | Co. | Bor. | Total | % | Co. | Bor. | Total | % | | |
| North | | 2 | 2 | 14 | 4 | 5 | 9 | 64 | 1 | 2 | 3 | 22 | 14 | .43 |
| Yorkshire E & W | | 3 | 3 | 23 | 1 | 5 | 6 | 46 | 1 | 3 | 4 | 31 | 13 | .69 |
| East Midlands | 3 | 2 | 5 | 36 | 4 | 2 | 6 | 43 | 1 | 2 | 3 | 21 | 14 | .43 |
| East Anglia | 1 | 1 | 2 | 25 | 4 | 1 | 5 | 62 | | 1 | 1 | 13 | 8 | .50 |
| Greater London | | 6 | 6 | 28 | | 13 | 13 | 62 | | 2 | 2 | 10 | 21 | .71 |
| South East | 9 | 6 | 15 | 65 | 3 | 1 | 4 | 17 | | 4 | 4 | 14 | 23 | .43 |
| South West | 3 | 1 | 4 | 31 | 4 | 2 | 6 | 46 | | 3 | 3 | 23 | 13 | .61 |
| West Midlands | 3 | 2 | 5 | 31 | 2 | 7 | 9 | 56 | | 2 | 2 | 13 | 16 | .50 |
| North West | | 1 | 1 | 4 | 2 | 9 | 11 | 46 | | 12 | 12 | 50 | 24 | .00 |
| Wales | | 1 | 1 | 6 | 6 | 3 | 9 | 53 | 7 | | 7 | 41 | 17 | .18 |
| | 19 | 25 | 44 | 27 | 30 | 48 | 78 | 48 | 10 | 31 | 41 | 25 | 163 | |

If the data for the two variables describing the regions is classified for each in three groups - "high", "moderate" and "low" - the pattern shown in Table 8.4 emerges.

In Wales and the North West where there were few or no early LEA in-service courses for the Nuffield O-level projects the percentage of high adopting LEAs in 1973 was low and the percentage of non-adopters high. These latter LEAs were the small Welsh county and the small N.W. county borough. In Greater London the high provision of courses was matched by the low proportion of non-adopting LEAs, but there were fewer high adopters.

Both Yorkshire (East and West) and the South West provided a high level of courses, but whereas this was associated with a relatively high level of use in 1973 in the South West, in Yorkshire only a moderate high-adopting group was displayed, together with a relatively large non-adopting group. The moderate provision of courses in East Anglia, the Midlands, the North and South East associated with moderate to high use of projects except for the percentage of high-adopters in the North. The large high adopting group of LEAs in the South East are mainly the relatively wealthy counties that were slow to reorganize secondary education.

Table 8.4. Summary of Early Course Provision and Use of Projects.

| Region | 1966 Course Provision/LEA | | | Use in 1973 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | High-adopters | | | Non-adopters[1] | | |
| | | | | Cat. | % | Rank | Cat. | % | Rank |
| Greater London | H | .71 | 1 | M | 28 | 5 | H | 10 | 1 |
| Yorkshire E & W | H | .69 | 2 | M | 23 | 7 | L | 31 | 8 |
| South West | H | .61 | 3 | H | 31 | 3 | M | 23 | 7 |
| East Anglia | M | .50 | 4 | M | 25 | 6 | H | 13 | 2 |
| West Midlands | M | .50 | 4 | H | 31 | 3 | H | 13 | 2 |
| North | M | .43 | 6 | L | 14 | 8 | M | 22 | 6 |
| East Midlands | M | .43 | 6 | H | 36 | 2 | M | 21 | 5 |
| South East | M | .43 | 6 | H | 65 | 1 | H | 17 | 4 |
| Wales | L | .18 | 9 | L | 6 | 9 | L | 41 | 9 |
| North West | L | .00 | 10 | L | 4 | 10 | L | 50 | 10 |

This analysis reveals an apparent low interest in the Nuffield O-level projects in the North West. It is perhaps relevant that this region produced one of the few responses made to a paper from the Schools Council in 1965 proposing local and regional centres for curriculum development. The region was organized into "areas" and set about developing the N-W Curriculum Project. The commitment to "grassroots" development possibly created insulation from projects originating from outside. Shipman (1974) shows the Keele Integrated Studies Project to have arisen from response to the same paper, but no continuing structure survived at Keele.

Further on the national scale the DES made its contribution through the short courses programme[2] organized by the Inspectorate in collaboration with various centres. From 1965 courses entitled "New approaches" were planned and advertisements contained references to Nuffield Science Teaching materials. Many included as tutors those involved in the development of the Nuffield projects. Applications for these courses were considerable, as Fig. 8.1 shows. The 1966 programme displayed the current assumption that in-service training was passing to local centres and there was the same concern as was shown by the Nuffield and Schools Council to train leaders for local courses.

Special "High level" courses were run, at Easter, for staff in University Departments and Colleges of Education and in the summer for school teachers in both mathematics and the sciences. The brochure explained "The aim of these high level courses will be to bring together for discussion groups of teachers with relevant experience especially those who have already done interesting work and who could be expected to develop this further and to take a leading part in local conferences and courses in their areas. The courses will be concerned with teaching techniques, fresh approaches to subjects taught in schools and new subject matter".

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[1] A low percentage of non-adopters is classed "high".

[2] See Appendix R (ii).

The policy in the early years was one of neutrality by HMIs towards the Nuffield materials, so that they were presented among other ideas for study and discussion. Later in 1969 and 1970 courses specifically to prepare teachers to use the O-level schemes (and in 1970, the A-level) were run.

An examination of the percentage of applicants gaining places on science courses over the years shows a very real attempt to meet demand. The constant exploration and sensitivity to demand is shown by the Science in General Studies provision: in 1969 two courses were planned, one was cancelled, the other ran, but with smaller numbers than were planned. The following year none was offered and in 1971 the proposed course was cancelled when it received only 14 applications.

Demand was frequently tested by offering a single course. The "New Approaches to Secondary School Science" in 1967 elicited a good response but none of the three courses offered in the summer of 1968 was filled: 180 teacher places were planned, 143 applied and 126 attended. The discrepancy between the last two figures suggests that as much as 10% of the applicants may withdraw from a course for some reason, so that an attendance percentage[1] of less than 100% does not imply exclusion of applicants prepared to attend.

Estimation of response to longer vacation courses was over-optimistic, however. In 1969 six week long refresher courses, each for 36 teachers, running three to four weeks into the summer vacation, were planned, two for non-graduates teaching science, two in each of biology, chemistry and physics, but only the chemistry course at University College, London, took place, and that with only 23 teachers participating, because of lack of response. A Welsh course in chemistry planned on a pattern of two weeks at Easter plus four weeks part time in June-July, was more successful. It ran for 34 teachers and was followed by similar courses in biology, physics and "Science for Comprehensive Schools" in Wales in 1970, with 20, 14 and 50 teachers attending the respective courses, and further courses in Nuffield A-level physics for 21 and 15 teachers respectively in 1971 and 1972

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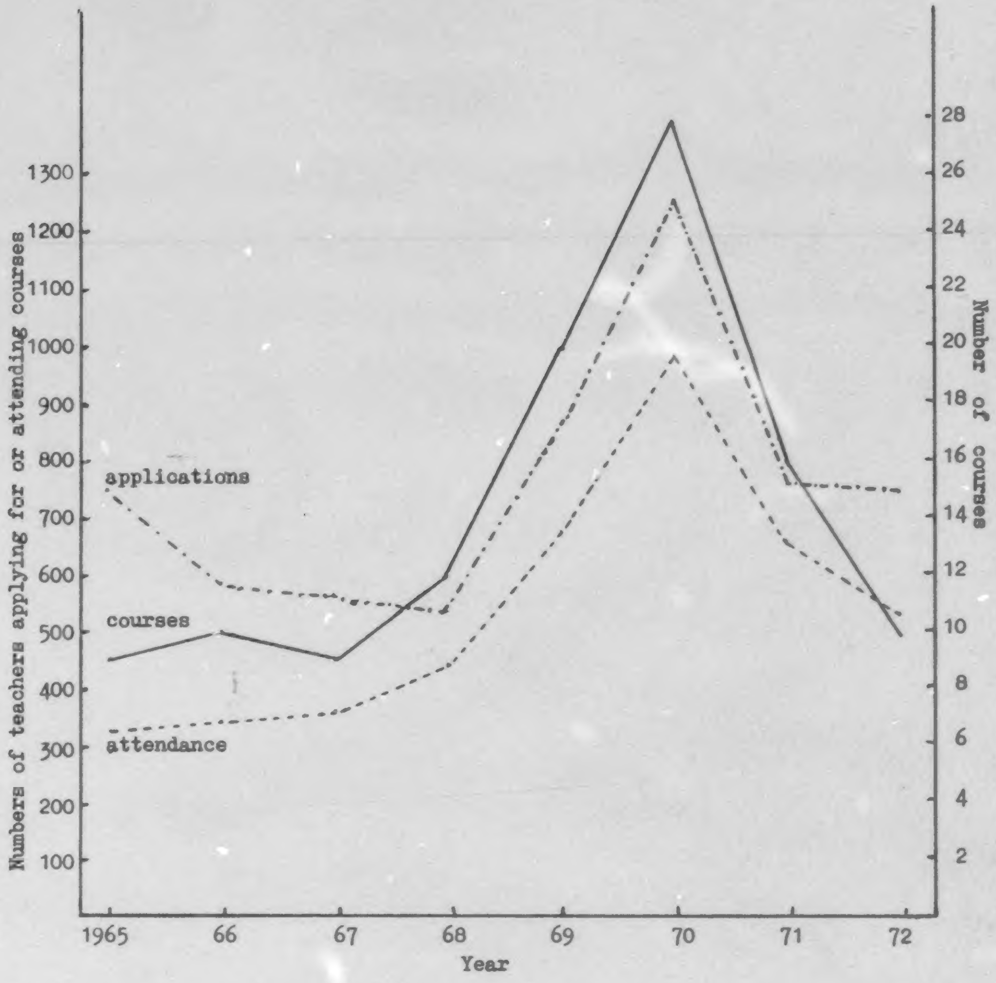
[1] Attendance percentage $= \frac{\text{no. attending x 100}}{\text{no. applying}}$

The marked increase of in-service activity associated with the development and publications of the Nuffield Science Teaching Project materials is shown at the national level by Figure 8.1.

**Fig. 8.1.** Provision of short courses in Secondary Science (DES), application and attendance figures for 1965 - 1972



When one adds to this the activity at the local level, (see later) with upwards of 2,000 teachers attending local courses in 1966 and the unknown, but possibly considerable numbers in subsequent years, as the three descriptive studies of local provision and the case study data suggest, this is a remarkable phenomenon and is one consequence of the nation-wide thrust of concern for science education which in the DES provision came to a peak of expression in 1970.

According to DES statistics[1] in no other subject area of the curriculum has a similar thrust been apparent. However, demand for "other courses", including ROSLA courses and those examining internal school organization, may be masked by the analysis into subject areas.

When total applications and percentage attendances are examined in different subject areas one remarkable observation is the greater response and corresponding disappointment of biology teachers of sixth form and O-level work[2]. This raises various questions -

- Why do biology teachers appear more anxious than either chemistry or physics teachers to attend a DES short course?
- Are biology teachers more aware of the need to keep in touch with or discuss new ideas in science education? (How does this correlate with the lower use of Nuffield materials in biology?)
- Is the local provision for biology teachers less adequate than for chemistry and physics? (See case-study evidence for importance to teachers of "professional" teachers centres and the frequent later development of a Biology Centre.)
- Are changes proposed in biology more far-reaching and therefore more likely to arouse insecurity, than in chemistry and physics?

etc.

Biology is different again in not displaying such a marked sex bias in applicants. Very often nearly equal numbers of men and women applied for and attended biology courses - not so in the physical sciences or in other areas of the science curriculum. This may reflect the greater proportion of women teaching biology[3] than other sciences or within integrated courses, it may indicate women have less responsibility in other areas than men have, it may indicate that women are less prepared than men to give time for in-service training (there may be some association with course attendance and career orientation), it may mean that family commitments constitute a greater obstacle to course attendance for women than for men.

Examination of percentage attendance in the physical sciences suggests that for some courses sex was a selection variable in that the same proportion of women applicants as men were admitted regardless of the smaller number of women applying. In other courses virtually all of the small number of women who applied were allowed to attend.

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1. Statistics in Education, Vol. 4, 1970 Teachers
2. A similarly low attendance percentage is shown for the O-level physics courses, but fewer applications were made than for the biology courses. See Appendix R(ii) for details.
3. Statistics in Education, Vol. 4, 1970, gives only total science figures for men and women in a "primary and secondary" category for maintained schools. This remained at women:men 1:24 for most of the years from 1965 - 1970.

## The local picture

It has in no way been possible to chart the provision of local courses throughout England and Wales since the publication of the first Nuffield Science Teaching materials. However, as a result of the preservation of programmes and course lists by individuals involved it is possible to describe what happened in three local areas: biology in a group of three London Boroughs, chemistry in a large Northern ATO involving one county and six county boroughs, and physics in East Anglia.

## The pattern of provision in biology in three London Boroughs

These three boroughs, together with the adjacent home county, formed Group 2[1] in the Schools Council's grouping of local authorities in 1965. Four teacher delegates (one from each LEA) were sent to the Portsmouth Conference in January 1966 and in the summer one of the four directed the week long course for biology teachers held in the Colleges of Technology and Further Education located in one of the boroughs, with the remaining three teachers acting as course tutors. Forty-two teachers took part (eleven from each borough and nine from the county) and several members of the Nuffield Biology development team contributed to the course.

A year later the same four teachers assumed responsibility for a one day follow-up conference, held in the same borough, to discuss progress in the use of the Nuffield Biology course in the area. A questionnaire was sent to each school participating in the 1966 course to determine the extent of use, enjoyment of parts of the course and problems arising from its use or preventing its use. Thirty-one out of forty schools responded and just over 100 replies to a pupil questionnaire were also collected. Forty-one teachers (more than 50% of whom had taken part in the course the previous year) attended the conference, a resumé of the results of the questionnaire was given, teachers using the course commented on their experiences and the formulation of a general poligy with respect to the Nuffield Biology Project was discussed.

The questionnaire revealed that of the 31 schools replying 16 were grammar, 10 secondary modern and 5 bilateral. Four schools declared they were committed to the Nuffield O-level examination, thirteen were undecided and ten were planning to continue with traditional courses.

In 1968 a full course was again mounted, this time within the county authority. It was directed by the same teacher as was the 1966 course and two of the four tutors were common to the two courses. Contributors were all local teachers. Experimental work contained in Years I and II of the course was carried out and discussed in detail, with some demonstrations from Years III and IV. Fifty-eight teachers participated, considerably more than half coming from the county's schools.

1969 saw a one day follow-up conference in July held in the same county technical college, but attended by only seventeen teachers. However, an inter-borough workshop course of ten fortnightly sessions of two and a half hours was held in the autumn of that year and the spring of 1970 in the original borough. It was staffed by teachers drawn from the three boroughs and it appears that the county was not involved. The programme included experimental work from all parts of the O-level course, followed by discussion and ended with a joint session involving those teachers participating in corresponding physics and chemistry courses.

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1. Deduced from the course number assigned to the delegates at the Portsmouth Conference.

If it can be assumed that the provision in physics and chemistry was similar to that in biology then a very comprehensive effort had been made to familiarize the science teachers in the three boroughs with the Nuffield O-level science materials. Examination of the 1973 use of projects in these three boroughs X, Y and Z shows that both Y and Z appear in the high adopter category, (with Z very high) and X is in the top 20% of adopters. The three authorities have shown very different patterns of secondary reorganization: in 1971 Y had a fully comprehensive system with middle schools, Z still operated a selective system with grammar and secondary modern schools (the latter being ignored when percentage up-take was calculated) and X appeared to be about half-way to a fully comprehensive system.

## The Pattern of Provision in Chemistry in part of the North

In the area under discusion the responsibility for providing in-service training in the Nuffield Science Projects was given by the Local Education Authorities to the Area Training Organization (ATO) which included parts of a County Authority (A) together with four small (B, C, D, E) and two larger county boroughs (F, G). The Institute of Education at the centre of the A.T.O. had already established a tradition of in-service courses in science during the early sixties and in 1966 the responsibility for running courses in connection with the Nuffield O-level Chemistry Project was assumed by a recently appointed member of the Institute staff who had been head of department in a chemistry trial school. He had contributed to the programme of the Manchester Chemistry Conference in January 1966 and he collected together a course team, most of whom had been trial school teachers (and not all were local) and some of whom moved into Departments of Education in other parts of the country.

The first course - one of the earliest in the country - was held during the summer term of 1966 at the Institute's Department of Education. It consisted of eight full day sessions and parallel courses in biology and physics took place at the same time. The teachers attending the course came from the following Authorities

| Authority | No. of teachers |
|---|---|
| A | 4 |
| B | 2 |
| C | 3 |
| D | 2 |
| E | 2 |
| F | 4 |
| G | 4 |
| Total | 21 |

A follow-up meeting was planned in the autumn to take place the following February "to discuss problems that may have arisen in teaching O-level Nuffield Chemistry".

In July 1966 the same organizers ran courses for a neighbouring county (H) and borough (J), located at the College of Technology in the borough. This was a five day course and included two local teachers in each science (since the name of one biologist appeared on the Portsmouth Conference list it is possible that all six were their authorities' delegates to the training conferences in January).

These courses must have required massive organizational efforts, since thirty-two teachers in each science (split into two groups of eighteen) attended the courses. The local authorities ordered sets of texts to year 3 for each member of the courses with the comment "The publications will be regarded as the property of the school concerned".

The county borough (J) followed up these courses with a two-day conference in June of 1968 using the theme "Two years of teaching Nuffield materials". There were one hundred participants from the borough, the C.E.O. opened the conference and local teachers contributed, as did members of the ATO "team" under discussion. The conference included talks on the four A-level projects and Combined Science and split into three groups to discuss "Problems of Teaching Nuffield in the Comprehensive School".

During 1967 the chemistry "organizer" in the ATO was busy with his team running courses in January and April, each of five days duration for twenty-one teachers (and contributing to courses run at Easter and July for different neighbouring county authorities and a course for Direct Grant and Independent schools). The April course was attended as follows:

| Authority | No. of teachers |
|---|---|
| A | 10 |
| B | 0 |
| C | 1 |
| D | 1 |
| E | 1 |
| F | 4 |
| G | 4 |

(No similar figures survive for the January course.)

Through the summer terms of 1968 and 1969 further courses in Nuffield O-level chemistry of eight sessions (afternoon and evening) were held in the Institute of Education, but in 1969 the emphasis was on sixth form work and the Nuffield A-level chemistry scheme.

The pattern of uptake in the areas A-J in 1973 is as follows:

| Authority | % uptake | Size | Type of secondary education in 1971 |
|---|---|---|---|
| A | 12 "adopter" | VL | about 50% pupils in comprehensive schools |
| B | 22 "high" | VS | selective |
| C | 33 "high" | S | selective |
| D | 27 "high" | S | selective |
| E | 0 "non-adopter" | VS | comprehensive |
| F | 9 "adopter" | L | mostly comprehensive |
| G | 9 "adopter" | L | selective |
| H | 0 "non-adopter" | SM | creamed comprehensive |
| J | 11 "adopter" | ML | comprehensive |

The most obvious association is between the small "selective" Authority and high adoption.

## Physics in part of East Anglia

A quite different pattern of local activity developed around the Physics project in two adjacent county authorities in East Anglia. Seven schools (all grammar or comprehensive), three from one LEA and four from the other, became trial schools for Year 1 of the materials in 1964. Teachers from each school had attended the Loughborough Conference in the summer of that year and continued to meet as a group until 1969 i.e. through the five years of the establishing of the course in their schools.

No outside agency organized the meetings; the schools took turns in acting as host. No "project" team member appeared to be present, but the locally based HMI and the General Secretary of the ASE, (the headquarters of which was then nearby) attended several of the meetings and appear on a headquarters' list as "area co-ordinators" for East Anglia. One teacher assumed the role of secretary in 1966 when the Central Organization was changing. He had kept a record of proceedings of earlier meetings for his headmaster, and in 1966 abstracted details from these to send to other members of the group. From then on minutes were kept and distributed. The comments that follow are deductions made from these minutes.

In the initial term of trials (Autumn 1964) three meetings were held but thereafter one or two took place each term. It appears that, on average, six schools were represented at each meeting, by a total of ten to twelve physics teachers, although it is possible that during the years 1967-69 more schools were associated with the group.

Problems arising from the use of trial materials were discussed and in 1966 it was reaffirmed that meetings should continue as "shop floor" discussions on work in progress, but welcoming interested observers. The first mention of these was in December 1965.

There was some concern in 1966 to develop parallel Chemistry and Biology meetings and the minutes of the following meeting refer to it dividing into Chemistry and Physics meetings, but joint meetings were apparently not sustained.

The attitude to the Nuffield Science teaching materials reflected in reported comments was far from enthusiastic. The teachers progressed cautiously through the materials, in apparent ignorance of the proposed later parts of the course until after publication. There were marked feelings of isolation in the group, which gradually developed into a sense of alienation from the project. They were affronted to hear that it was planned to staff local courses through the country in 1966 by teachers who had met the materials only in a course and had not themselves been involved in trials. They complained to the Continuation Group at Mary Ward House that information was being withheld from them and that they "should not have to watch the public press to see what was happening".

It seems that they received no feedback from the Nuffield Science Teaching Project in reply to their reports and in 1969 expressed disappointment that the ASE appeared to be taking no further active part in their meetings. At the next meeting this was expressed more strongly, together with complaints that all attempts to improve communication between "the authors and perpetuators of the scheme and the classroom teachers who have to put it into

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The minutes of meetings from January 1967 to Easter 1969 were missing from the set made available to the Curriculum Diffusion Research Project. Efforts to locate others have so far been unsuccessful.

practice" had failed. There was a "growing feeling that whatever the classroom teacher may think of Nuffield, his ideas for modification and improvement had no chance of a hearing in the face of the apparent self-complacency with which those responsible for the Nuffield mystique have armoured themselves".

Only four teachers attended this meeting and one last appeal was made to all who had been in contact over the years to make an effort to attend the next if they wished the meetings to continue. In the event only seven teachers responded from five schools so that no further meetings were planned.

However, from the perspective of the Physics Project Team the group had a limited role. It had been set up for one year of trials. During this year it was estimated that 82 classes were involved in the testing of Year 1 of the materials within a total of 49 trial schools[1], some of which were also testing the materials for other years. The group therefore formed only a small part of a large operation. Its usefulness as a trial school for the project came to an end in 1965, but the group continued to meet and expected feedback from the project to their comments. There was, quite obviously, a breakdown in communication between the local group and the central team. Inaccurate statements in the local minutes about changes occurring in the central organization suggest that the local group had little real knowledge of how the project was organized.

Evidence from the 1966 Summer Course list (see page 8.01) and minutes suggest that neither LEA involved assumed responsibility for an in-service programme for local teachers. The function of the local group became one of mutual support, in the exploration of new material. Any less parochial role was frustrated. Although it is apparent that other schools became involved with the group from time to time, none within the two LEAs was influenced to use the project to examination. However, in spite of their reservations about the suitability of the course, six of the original schools entered candidates for the examination in 1969. One presented no other group in subsequent years, but five schools continued with the full course until the present time, (although one of these did not enter candidates in the last year, 1973, after becoming a Sixth Form College).

To the observer at this distance in time the initiation of such a coherent group of responsible physics teachers and their subsequent non-use seems a wasted opportunity in local curriculum development - here was fertile soil, with lively grass roots. The official positions of the area co-ordinators required them to distance themselves from the project so that they may have felt unable to act as cultivators. A local science adviser may have affected events differently.

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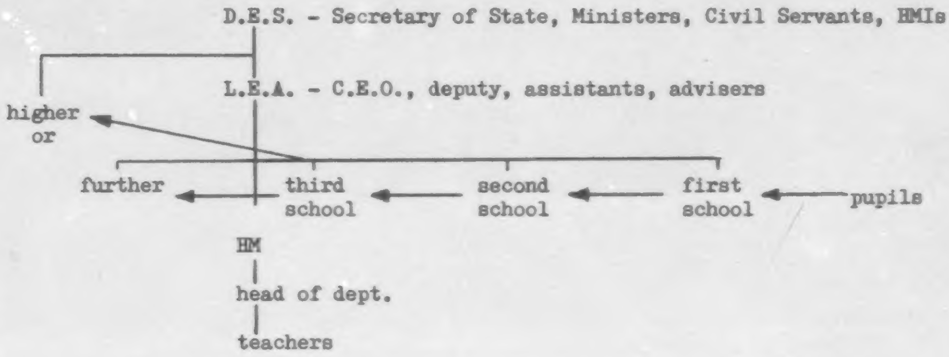
[1] The Nuffield Foundation Science Teaching Project Progress Report October 1964.

# PART III THE L.E.A. PERSPECTIVE

## CHAPTER 9

### WHO HAS RESPONSIBILITY FOR THE CURRICULUM?

Kogan (1973b) has argued that in education there is a plurality of both values and institutions. Levels of responsibility and decision-making may be represented broadly thus -


D.E.S. - Secretary of State, Ministers, Civil Servants, HMIs
L.E.A. - C.E.O., deputy, assistants, advisers
higher or
further
third school
second school
first school
pupils
HM
head of dept.
teachers

Historically[1] the school has assumed responsibility for the curriculum, but within the constraints of structures the power of which operates through consensus and social pressure. The curriculum of the newly-created secondary schools of the early twentieth century was deliberately patterned on that of the public schools by *central* government policy. Grants, administered by the new LEAs, were available only to those schools which provided acceptable courses. The content and standard of these were approved by HMIs. This changed the direction in which science education was developing under the *local* School Boards with support from the Department of Science and Art.

Inevitably the eyes of these "grammar" schools turned to universities and professions and their pupils competed for entrance through prescribed examinations. The pressure of a multiplicity of examinations led to the setting up of the School Certificate which was increasingly used by the universities for matriculation exemption, and by professions and employers for selection purposes. When the grant restrictions were lifted they were effectively replaced by examination constraints. Formulations of the Elementary Code allowed increasingly more freedom to these schools but the transfer of able pupils to the grammar schools from the parallel but truncated elementary schools and the eventual turning of this to a tiered system, with selection to grammar schools required *tests* and *standards* that inevitably constrained first the elementary and then, more completely, the primary schools. The gradual disappearance of selection at 11+ has released the primary schools from these constraints and enabled them to respond more freely to the growing consensus in favour of more child-centred, activity type learning.

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1. Lecture at Queen Mary College, 4 December 1973.

The introduction of the General Certificate of Education in 1951 was intended to free the schools and pupils from some of the constraints of the leaving certificate examinations. This it succeeded in doing in the change to single subject from group examinations but not in postponing the taking of a public examination in a subject to the terminal stage of itsstudy at school. Here the pressure of employers and selectors, perceived by pupils and their parents, was too powerful. Many grammar school teachers therefore never really assumed responsibility for large areas of curricular decision-making. For some, however, there was an increasingly large representation on examining boards, and as few made use of the available Mode 2 examining, it was assumed most teachers were satisfied[1]. Moreover the massive sales of many popular textbooks preparing specifically for O and A level examinations suggested a further surrender of responsibility by the teacher to the text book.

By the 1960s the increasing use of the GCE O-level and other examinations by secondary modern schools had led to the demand that a special lower level examination be provided. The structure of the resulting Certificate for Secondary Education (CSE) gave teachers control of syllabuses and, if they wished, of examinations under regional Board approval and moderation. The variety of responses of teachers in different regions to this opportunity would make an interesting study and suggests a dependence on LEA leadership.

In the science curriculum, as in other areas, Central Government, through first the Board of Education and then the Ministry of Education, followed the Thomson Report[2] with periodic recommendations.[3]

Within the science community pressure groups operated from time to time. Harding (1971) has briefly surveyed the struggle to establish science in the nineteenth century school curriculum. The British Association (1917, 1928, 1933) published several reports on the teaching of science in schools. More recently the professional bodies have set up committees to consider the teaching of the separate sciences (e.g. the British Committee on Chemical Education in 1962 "to promote the improvement of chemistry teaching in schools" (Chisman 1963) ). But most significant has been the work of the Science Masters' Association (SMA) in collaboration with the Association of Women Science Teachers (AWST)[4].

Over the years, from the publishing of "Science for All - a plea for General Science" in 1920, and the persuasion of examining boards to include papers in General Science in the School Certificate from 1924, the Association moved from active support of General Science to emphasis on specialist science courses. 1961 saw the production of "Physics for Grammar Schools" together with the corresponding booklets for Chemistry and Biology. Sales were reported to have exceeded expectation and syllabuses to be influencing examination boards[5].

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[1] See Schools Council Dialogue No.7 for a further opinion by S.W. Exworthy on teachers' acceptance of this state of affairs.

[2] "Natural Science in Education" (Report of the Prime Minister's Committee on Science in Education) 1918, HMSO.

[3] e.g. 1925 Teaching of Science in Secondary Schools
1933 Science in Senior Schools
1960 Science in Secondary Schools, Pamphlet No.38.

[4] They amalgamated in 1963 to form the Association of Science Education.

[5] SMA Bulletin No.1, April 1960. Sales: Biology 1590, Chemistry 1965, Physics 2190.

Part I of the physics syllabus was used in what was to be referred to as the Studley Experiment[1(a)]. Three examining boards co-operated in this experiment in which 30 schools, (involving "a higher proportion of independent and direct grant schools higher than the national proportion"[1(b)]) tried out materials in 1962-1964. It was concluded that "the 'modern physics' appears to have been added to a traditional course, whereas the course ought to be regarded as an integral three or more years' work".[1(b)] But radical revision was in the air and had been initiated by the professional body of science teachers.

The Nuffield Science Teaching Project was set up in 1962[2]. The central teams for each of the separate science O-level projects contained names from the Biology, Chemistry and Physics Panels of the SMA/AWST.

Significantly central government moved more actively into "the secret garden of the curriculum"[3], with the formation of the Curriculum Study Group of the Ministry of Education. Manzer (1970) reports the hostility with which this was greeted by Education Committee and LEA organizations and by teachers' unions - the accepted pattern of assumed and delegated responsibilities appeared to be threatened by central government intervention. Negotiations led to the creation of the Schools Council for Curriculum and Examinations in 1964 which became an independent body in 1970, jointly funded by local and central government, but with large teacher representation. It, too, set about developing curricular packages at the national level, but carefully emphasized the autonomy of the schools in choosing to use them.[4]

What, then, is the further responsibility of the L.E.A. for the curriculum and how does it perceive the national curriculum development project?

Kogan (1971) comments - "While variations in school characteristics result from many things . . . the disposition of local authorities themselves must be a large factor in the promotion or frustration of new approaches." He defines "the tasks for which the local (education) authority is created and on which it is judged:

1. the teaching of children, and helping them to learn;
2. the provision of physical facilities within which teaching and learning can take place;
3. the provision of school meals;
4. the provision of a school medical and dental service;
5. the ascertainment of children with physical or mental handicaps requiring special educational treatment;
6. the provision of physical training and recreation facilities for the community at large;
7. the provision of training facilities for teachers;

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[1] ASE Bulletins (a) No.9, April 1962, (b) No.14, September 1965

[2] See Waring (1975).

[3] Sir David Eccles, House of Commons speech, March 21, 1960.

[4] Schools Council Dialogue No. 7 "The freedom of the teacher" and Dialogue No. 12 "Dissemination: the task of the Working Party".

8. the enforcement of the statutory provisions for school attendance;
9. the assessment of claims for, and the award of, statutory and discretionary grants;
10. the control of employment of children and young persons of compulsory school age;
11. the assessment of the educational needs of the area with a view to specifying desirable developments, and carrying them through;
12. the dissemination of knowledge about, and encouragement of support for, education in the community which uses it."

Responsibilities for the curriculum derive from 1, 2, 7 and 11 -

(1) requires the authority to appoint teachers and to provide other aids to learning,

(2) requires the provision of adequate buildings with laboratories, workshops, home economics rooms, etc.,

(7) places the responsibility for providing training facilities for teachers firmly with the LEA. It may discharge its initial training commitment through the "pool", but must make its own arrangements for in-service training,

(11) places the burden of development and perhaps innovation on the authority.

The interpretation by LEA personnel of these responsibilities was explored in the open interviews and is discussed in the following chapter.

## CHAPTER 10

## THE L.E.A. PERCEPTION OF CHANGE AND CURRICULAR RESPONSIBILITIES

Through the autumn of 1971 and the spring of 1972 personnel in sixteen local education authorities were interviewed by members of the Curriculum Diffusion Research Project and asked for opinions on change and innovation in the schools and especially in science education, and for information about the diffusion of national curriculum projects into their schools[1].

The people interviewed held various positions in the education office: 1 Chief Education Officer, 4 Assistant Education Officers, 6 Chief Inspectors (Advisers), 6 Science Advisers, 5 General Advisers, 1 teacher.

One may confidently assume that most had been teachers (all but one were men) and responses revealed the facility with which some were able to switch from a "school" view to an "authority" view within their position between the Education Committee and the schools, administering policies and presenting claims from the schools.

### The Authority's total view.

The Authority's responsibility within its area for all children, all schools and all parts of the curriculum was apparent, leading to emphases on "fairness" and balance. This came out in the attitudes to the allocation of funds between schools, discussed later, but also in their perception of the "coverage" of the science projects. For some there had been too much emphasis on the able pupil: "The LEA spent a lot of money on new O-level projects which did only a small proportion of pupils any good". A new CEO, having apparently surveyed what had been done in his Authority, "circulated a letter saying there should be more emphasis now on the arts for the inner man".

### The importance of persons in positions of responsibility.

But there was also a realization that the LEA may itself be responsible for bias. The early support for, and interest in, the Nuffield Science projects in one area was attributed to a D.E.O. who had been a science teacher. In another "an adviser with access to funds led to considerable adoption of the new humanities programme". The response of yet another Authority to the publishing of the science project materials was to equip all its secondary schools with language laboratories. As one official commented "the accident of people's influence in key positions can be very significant even in ------ " (a large Authority).[2]

The dependence of the national curriculum project on personal support and diffusion was mentioned more than once: "just one person, part-time, co-ordinating a local effort can make an enormous difference in impact", "Nuffield French had no-one to push it", "the Humanities Project will be delayed because there is no-one to sell it", "the presence of a science adviser can make a tremendous difference". Three

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1. See Appendix Q(i) for check list.

2. This is illustrated also in Kogan's studies of C.E.O.s which show the support given to Modern Mathematics at Hillingdon and Nuffield French at Leeds. (M. Kogan, 1973a)

other Authorities expressed their need for an adviser to aid communication and to co-ordinate work in science.

It was apparent that the existence of "advisers", "inspectors", or "organizers" in various subject areas was not the result of an overall policy plan in most areas. One authority associated the creation of this kind of post with safety aspects of certain subjects, while another saw it as a more general response to comprehensive reorganization.

But some Authorities were reluctant to employ "curriculum" personnel at the administrator level. This is shown by those in our sample who commented: "The LEA has invested funds in staffing of schools rather than in administration and has, as a result, a very favourable pupil/staff ratio" and "our policy has been to respond to expressed needs and wishes of the teaching staff rather than have advisory administrators taking the lead in innovation diffusion".

The decisions made by a local authority not forming part of our sample is of interest here. (J. C. Dunn, 1973)

> "Our analysis of the procedures of the early Schools Council models suggested that because the production of materials in many of the projects and the implicit release of staff for training or evaluatory purposes involved both financial and academic assistance to the schools, it was likely that both an "administrator" and a subject expert might be involved in promoting a project. We realized that this might suggest a degree of central direction in the process of curriculum development and from the outset we were conscious of the possible interpretation of this situation. All that can be said is that the Authority has always deliberately striven to preserve by its procedures the ultimate inviolable independence of the teacher. To state the need for leadership and benevolent direction in curriculum development is not to stress hierarchy. It is simply to suggest effective influence by respect and action and a realistic sense of urgency."

The role that these "advisory administrators" now fill is complex and ambiguous and a study of it was developed further.[1]

Origins of change

Changes in the curriculum were frequently attributed to changes in structure (Hoyle, 1971, terms these "power-coercive" strategies for change): "RSLA required rethinking of the whole curriculum", "comprehensivization provided a push towards curriculum development", "The CSE examinations made an enormous difference in secondary schools. The co-operation to produce a syllabus and the identification of direction provided a surge forward." This kind of change was acceptable and focussed attention on a particular educational task, but some viewed national curriculum projects with caution. This was perhaps change for the sake of change, and "change can be accelerated out of all proportion". They questioned the authority of the developers and their right to take the initiative. One referred to "middle-class meddlers". Another saw no real need for projects "There are too many projects; innovation is done to death and is devalued with so much of it". National projects can be positively dangerous, deflecting from "concentration on a few problems instead of killing the goose which lays the golden egg .....

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1. See Chapter 13.

innovation is becoming a kind of seduction in which the expectation of results from adoption is not fulfilled. Wanting a revolution through curriculum and attitude is unrealistic. Change is the order of the day; it will come with or without development projects."

The very structural changes promoting curricular change sometimes reduced the impact of certain national projects and enhanced others: "Part of the reason for few schools entering Nuffield examinations is there was not much push to do O-level five years ago. Nuffield Secondary Science is more economical and suitable for comprehensive schools than the Nuffield O-level subjects and two years ago Secondary Science received more push". "Reorganization may inhibit schools from going into new schemes as with two schools in ------ that just went comprehensive" and "The greater number of Nuffield O-level projects in -------- may be partly due to the longer continuation of grammar schools".

The multiplicity of projects received comments from some: "Nearly 100 Schools Council projects makes it difficult for heads to know all the innovations" - emphasizing how the level or nature of appointment influences the impact of total curriculum projects. These are largely directed at the teacher in the classroom and for any single teacher far fewer projects are visible than to a head or an LEA administrator."

## The "autonomy" of the school

In many interviews it was emphasized that curriculum matters were the responsibility of the schools and the teachers, their own authority was minimal: "It is not easy to change established teachers - science advisers have no authority in the schools." "Schools would be very suspicious of a centralized attempt to impose more conformity." "Innovations which come from the 'grass-roots' rather than being imposed by authority are much healthier." "A locally devised innovation has a better chance of success as the teachers see themselves as part of the innovation." "Any suggestion of telling teachers what to do is immediately rejected." "There is not much pressure from the LEA to the schools."

## The influence of the Head Teacher

The role of the head teacher enables him to influence change. One Authority saw the strength of influence to be "HM, staff, facilities and equipment - in that order." "When teachers want a particular innovation they approach the science adviser directly but the autonomy of the head is strong enough to stop it if he does not favour it." Others agreed that "if the head is not on your side there is a battle to get something adopted" and "Heads can be 'stumbling blocks' in innovation - especially if they do not have a wide range of experience". One officer, who had recently moved from the north to a more southern LEA, suggested that heads assumed more authority in the south and the activities in a school are largely affected by the head "--------- closes early two days of the week for in-service and curriculum development". Another stated "the head has absolute right to do, within reason, what he wishes in the school". But "persuasion is possible" and "most heads support innovations if they are presented well". "They can sit on staff to get things done", but "heads respect the heads of departments" though they, too, can "suffocate innovation". "Everything depends on the enthusiasm of the teacher, though the head can have an effect, especially in raising the level of accountability".

## Staffing

Staffing problems affected some schools. "It is almost no use trying to feed experiments into the schools with the high staff turnover." The use of "colonial" teachers, seen to be familiar with more formal approaches, restricted innovation in another Authority. In one area "marriage, maternity and mobility" were problems. However, elsewhere "a condition of lethargy is a result of being in one institution too long." National curriculum projects were seen to be ineffective without the commitment of the teacher and "a locally-devised innovation has a better chance of success as the teachers see themselves as part of the innovation".

## In-service courses

Given national curriculum projects, what happens within a Local Authority? As indicated in Chapter 8, the Schools Council assumed the provision of in-service courses (Task 7) to be the responsibility of the Local Authorities, though ".....others will no doubt wish to rely on standing arrangements with Institutes of Education".[1]

A very small minority of our sample appeared to mount their own courses. One commented that teachers would not attend courses "if only organized by the LEA". Another stated that "examination work was the job of the Institutes", while for another the A.T.O. providing courses was "worlds away" (16 miles) from its own insular community. Not many were in the position of one large Authority that provided courses, on a day-release pattern approved by the Education Committee, encouraged teachers "to get a taste of a project" and if they were not ready, sent them on a one term's course. The Science Adviser in this Authority had carefully selected parts of the different projects that gave the "real flavour" of the project, so that teachers could use these initially, then, if they did not like them, they could be dropped "with no harm done". Generally, however, a trial run was not encouraged "teachers are expected to have thought it out beforehand", but one Authority mentioned that the initial grant was renewed for a second year "when the programme proves itself in the school". A second large Authority provided courses and insisted that a teacher had followed a course before it agreed to support the project in the school. Both these Authorities had science inspector appointments of long standing and felt justified in withholding support for a course if they felt the teacher could not handle it.

The importance of in-service courses for change in general, or for the adoption of curriculum projects, was recognized: "pinnacles of development (came) from teachers who had been on courses", "innovations come out of .... teachers attending courses" and "demand from teachers for new schemes really begins after teachers attend in-service courses". One Authority was uncertain of the causal direction: "teachers who go on courses tend to be committed to change" and this Authority supported teachers at courses "only if they can subsequently be used in programmes in the LEA". In another area no such constraint applied - "over 90% of all physics and biology teachers have attended programmes dealing with equipment, experiments, approach to teaching and organization of practical work". (In this area there was less interest among chemistry teachers.)

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1. Association for Science Education Bulletin, No.15, November 1965.

## Trial schools

It is now general practice for project developers to approach schools for trial purposes through the Local Authority. This allows, of course, for a selective response at the LEA level. One mentioned the selection of schools to spread trials of A-level Chemistry geographically through the county; another provided five schools for Secondary Science trials - "the LEA wanted more but there was limited financial help". Others implied a more general acceptance of responsibility. "When new projects are formed the LEA often invites a school to be involved."

Most recognized the effectiveness of a trial school in generating interest in the project: "The presence of a trial school greatly influences the adoption of a scheme." "Trial schools are a launching pad in this Authority."

## Finance

Schools who wish to use curriculum development project materials require financial support usually in addition to the capitation allowance for their department. The extent of this will vary with the nature of the materials and, in the case of the science projects, specially developed apparatus adds to the cost of implementation. Two factors operated in determining whether money was available for the Nuffield Projects:

1. the preparedness of Education Committees to meet requests for funds beyond the conventional "capitation" and "capital estimates" categories and any limits set on amounts granted and
2. the mechanism employed to release these funds.

Financial procedures appeared to vary greatly between authorities - some allowed the head of the school discretion in how a global sum was allocated, even to determining whether an additional teacher or curriculum materials or further ancilliary help was employed. Others apparently put aside a sum to be distributed by the LEA officers for developments of some kind, (sometimes specified for "Nuffield science programmes"), while others examined specific requests from each school. Sometimes the time lapse between requests for support from the schools and its becoming available in the last case was as long as three years, but was more usually between one and two years.

In the Authorities possessing a key person (usually a science adviser), alert to the financial demands of the Nuffield science programme in 1966, sums were set aside for the implementation of these courses in the schools. In a few cases the amount was sufficient to cause little financial barriers to the schools who wished to use the project materials. Where funds were available, but limited, the officials were faced with the dilemma of whether to be "fair" and spread thinly or whether to allocate adequately where they would be used most effectively: "the inspectors and AEOs 'play Solomon' and base approval on knowledge of head and the school". If the schools formed a close-knit community "word gets around" and it was less easy for officials to discriminate. More than one Authority used attendance at a course as a measure of commitment when considering a teacher's request for support and, as already mentioned, a few felt justified in withholding support altogether, if the teacher was judged incapable of using the materials.

One Authority stated specifically that it had no special funds available, while another had received no requests from the schools and "it would be silly for advisers to go round schools saying that money was available".

## Perception of innovators

Some Authorities feared that the status of the Nuffield projects could lead the teacher to adopt for career advancement only. The "band wagon" effect was referred to more than once in the interviews. This affected the perception of "the innovator": "the innovative teacher often has more energy than intelligence", while the impatience of the probationary teacher to effect change has further devalued the concept for some. (Probationers were seen to be badly trained and with skills too specialized for the needs of the schools.)

A more sympathetic view of innovators saw them as "persons with openness of mind and humility", they were "willing to take risks in their own subject, free from 'band wagon' mentality, ready to come together with other people" and "not out to build their own empire". "Innovators tend to be active people who always seem to have time to talk when visited. They can do this and not lose control of the class." The innovator "reads widely .... is involved with ASE ... passes innovation into exams and is on the giving side of in-service training". "Implementers will change when the situation is right, innovators will change regardless of surroundings." One man suggested that "the science adviser may be 'creating' a particular type of innovator in that he pushes certain teachers who are doing what he likes."

## Communications

The level of communication within an area appeared a problem to many. Some made conscious efforts to bring people together - often at head teacher level - others welcomed changes that resulted in increased communication. The weekly LEA bulletin was used by some to inform teachers about projects and courses but "they never read it". A special Science Digest was circulated to teachers in one area to spread information on new curricula. Another referred to a bulletin "Science in Schools" that set out LEA policy. An Authority with a science centre used much of its supporting funds to produce an impressive bound booklet of annual activities. Its own residential in-service training college was seen by another Authority as "the main focal point of communication", but largely for primary teachers. This appeared to be true of many LEA teachers' centres, unless they were created specifically as science centres. Several mentioned the usefulness of a local higher education institution in improving communication with and between science teachers, while those without such centres regretted their absence.

## The influence of the Association for Science Education

The involvement of teachers with the ASE was an important element in communication in some areas, but even where there was an active branch "many teachers are not members". One science adviser reported that a questionnaire he had administered had revealed that only six science teachers (17 comprehensive schools) had been members of professional scientific societies and about 50% were members of the ASE - "many feel it is too high-powered - that they are not catering for the ordinary teacher". Other authorities agreed with this criticism: "the ASE meetings tend to put people off with its emphasis on career people, i.e. vigorous people who put ordinary mortals to shame" and "the ASE is disappointing as it is orientated to grammar and public schools and contributes little to comprehensive school needs". "No middle school teachers are members" in one area, in another "No professional associations or ASE touch (our) schools". A further Authority found "the ASE is not too helpful locally - only about half belong" while in another "CSE is more successful in bringing people together than ASE". However, one Authority in an area containing several industrial and government research centres saw the ASE as influential and lending credibility to Nuffield courses because of the perceived association between these and the ASE.

As one read the reports of the interviews it became apparent that in some areas there was high activity directed towards Curriculum Development Projects, while in others little appeared to be taking place.

Certain factors, relating to the LEA and surrounding areas, were frequently mentioned as significantly affecting the use of curriculum project materials. It became obvious that it would be necessary to make some kind of comparison between areas in terms of these factors, and to attempt to correlate variables in the factors with the familiarity and use of the projects.

## CHAPTER 11

## THE COMMUNICATION-SUPPORT SYSTEM

The influences on the use of projects, external to the school, mentioned in the LEA reports, were classified into six factors:

LEA procedure as it affected curriculum projects,
the occurrence of a trial school in the LEA area,
the presence of key persons,
the presence of accessible centres relevant to science education,
the comprehensive reorganization of secondary schools,
certain geographically - or socially - based characteristics.

The elements that contributed to the factors were identified and their positive or negative influence on the use of projects was indicated as shown in Table 11.1. Comprehensive reorganization was omitted at this stage, as the way in which it operated on the up-take of projects was variable.

The synthesis of elements and factors was termed the communication-support system; it constituted the local environment within which decisions were made in schools about the use of curriculum projects.

As described in Chapter 2, it was suggested that the concept of a measurable communication-support system could be used to identify locations in which to carry out case-studies and to formulate hypotheses relating communication and support to familiarity and use of projects.

Members of the research group were asked to obtain a score for each LEA in the sample, from the reports of the interviews with them. The mere presence of an element was scored (+) or (-), as shown in Table 11.1, and the LEAs were ranked according to their total crude scores. The overall ranking obtained in each of four attempts was consistent, apart from a group of three LEAs jostling for the penultimate lowest place. But three problems were recognized:

(i) it was possible that further relevant elements existed but had been mentioned in none of the interviews,

(ii) the information had been obtained in relatively unstructured interviews; the LEAs had not been asked directly about each element, so that the data were incomplete across even the elements that were included,

(iii) each element carried equal weighting in the total score and there was no foundation for this assumption, indeed, it was expected that some elements would be more influential than others. We were faced with the problem, discussed in Chapter 3, of forcing our data into simple numerical relationships.

The following procedures were therefore carried out in an attempt to solve these problems.

An account of the proposed communication-support system was sent to science HMIs and to other workers in the field of curriculum diffusion for comment and with a request that any further factor or element should be added. The only additional factor mentioned was that of comprehensive reorganization, which had already been

## Table 11.1. Communication-Support system relevant to curriculum development in science

The five factors forming the communication-support system as it emerged from the interview reports were built up of contributory elements. These are set out below, together with an indication of their positive or negative influences on the use of curriculum development projects.

### 1. LEA procedure as it affects curriculum development

| | | |
|---|---|---|
| (a) | Cumbersome financial machinery mentioned | (-) |
| (b) | Special grants made available | (+) |
| (c) | Special curriculum development centres or groups operating | (+) |
| (d) | Provision or support of courses | (+) |
| (e) | Identification of teachers in need of special training | (+) |
| (f) | Identification and use of "active" teachers | (+) |
| (g) | Follow-up of adoption | (+) |
| (h) | Provision of special information bulletin in science | (+) |
| (i) | Reference to waiting for initiative from teachers | (-) |

### 2. Presence of trial school

The presence of at least one trial school in each of the following science projects was included for scoring purposes.

| | | |
|---|---|---|
| (a) | O-level biology | (+) |
| (b) | O-level chemistry | (+) |
| (c) | O-level physics | (+) |
| (d) | Secondary Science | (+) |
| (e) | Combined Science | (+) |
| (f) | S.C.I.S.P. | (+) |

### 3. Key persons mentioned

| | | |
|---|---|---|
| (a) | A teacher fulfilling a leadership role | (+) |
| (b) | Science adviser | (+) |
| (c) | Science HMI | (+) |
| (d) | "Link" man | (+) |
| (e) | Other | (+) |

### 4. Accessible status "centres"

| | | |
|---|---|---|
| (a) | LEA teachers' centre with adequate science | (+) |
| (b) | School of Education (etc) with concern for curriculum development in science | (+) |
| (c) | Active A.S.E. group | (+) |
| (d) | "Professional" science teachers' centres | (+) |
| (e) | Industrial links | (+) |

### 5. Characteristics of area

| | | |
|---|---|---|
| (a) | Insularity | (-) |
| (b) | High staff turnover | (-) |
| (c) | Travelling problems | (-) |

recognized, but omitted because of its complexity.

A questionnaire[1] was designed, in collaboration with three science advisers, to obtain from the sample LEAs information on all the elements comprising the communication-support system. The responses to this questionnaire are discussed in Chapter 12.

An attempt was made to assess the validity and relative weighting of the parts of the proposed system by inviting HMIs and science advisers to ascribe percentage weightings to elements in a revised form of the system. This is discussed in Chapter 14.

## The use of the communication-support system in research strategy.

(i) To identify locations in which to pursue case studies.

The chief aims of the case-studies were to make comparisons and to explore the processes of communication and decision-making. It was suggested that one way of structuring the enquiry to encompass these aims would be to identify LEA areas scoring high in communication-support and those with low scores. Teachers in the schools in these areas would operate within identifiably different environments. If the level of communication-support activity influences the use of projects this should be apparent in the school systems.

But from the O-level entries data it was obvious that science teachers in schools acted independently of each other, at least when comparisons were made between the sciences. In each area, therefore, one would expect to find those teachers who use projects extensively and those who do not, leading to a four cell analysis, as shown in Table 11.2.

Table 11.2. Four-cell analysis of communication-support and use of projects

| | | At Local Environment Level | |
|---|---|---|---|
| | | High Communication-Support | Low Communication-Support |
| At Teacher Level | Users of Projects | P | Q |
| | Non-users of Projects | R | S |

It was anticipated that enquiries in schools within cells P, Q, R and S might lead to interesting comparisons of communication patterns and provide data for an investigation into decision-making.

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[1] See Appendix Q.(ii)

As it was necessary to make an early decision on the local authority areas for case-studies, to enable work to get underway, it was agreed that the provisional ranking of LEA areas, although its overall validity was in doubt, formed an acceptable basis for the identification of relatively high- and low-level communication-support systems.[1]

(ii) To formulate and test hypotheses relating communication-support to familiarity and use of projects.

It is possible to hypothesize that a high level communication-support system $\left.\begin{array}{l}\text{leads to}\\ \text{is associated with}\\ \text{arises from}\end{array}\right\}$ a high level of familiarity and use of curriculum development projects in the associated school system. To test these hypotheses one must have confidence in the validity of the derived indices for the LEA area both of "communication-support" and of "familiarity and use". This presented problems for the research which were never fully overcome and which are discussed in Chapter 14.

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1. See Appendix S.(i) for the choice of LEAs dependent on this decision.

## CHAPTER 12

## COMMUNICATION-SUPPORT IN TWELVE LOCAL EDUCATION AUTHORITIES

The communication-support system was derived from the composite picture (presented by the open interviews with the eighteen local education authorities in our sample) of the context into which curriculum projects were received. In order to obtain comparative data for these authorities a questionnaire[1] was designed, with the help of three science advisers from LEAs not included in the sample. This was sent to the eighteen authorities in the spring of 1973, but the questionnaire was completed by only twelve of them. Of the seven county authorities five responded, but only three of the seven county boroughs did so; replies were obtained from all four London Boroughs. Although the date for local government reorganization was more than a year away, the extra work associated with this was given, in some cases, as the reason for not completing the questionnaire. But in others (and this was apparent too in some of the returns we did receive) there was no readily available record of the kind of information we required.

However, the data provided by the twelve responding LEAs were analysed and for each of fourteen items the LEAs were graded over a five point scale.[2]

### Discussion of responses from 12 LEAs

### (a) Teachers' Centres

The Schools Council looked to the establishing of teachers' groups and centres to further the work of curriculum development.[3] By the spring of 1973 each of the twelve authorities had set up at least one teachers' centre, but the pattern of provision bore little relationship to the size of the authority.

Table 12.1

| No. of Centres | No. of LEAs | Size Categories[4] |
|---|---|---|
| 6 | 1 | ML |
| 4 | 1 | L |
| 3 | 1 | M |
| 2 | 4 | L, L, ML, SM |
| 1 | 5 | M, M, SM, S, S |

Most of these centres appear to owe their origin to the lead given by the Schools Council, since most were established after 1967:

Table 12.2

| Year | No. of centres established | |
|---|---|---|
| 1956 | 1) | all in one LEA<br>(2 are science centres) |
| 1963 | 1) | |
| 1966 | 1) | |
| 1967 | 2 | |
| 1968 | 3 | |
| 1969 | 2 | |
| 1970 | 4 | |
| 1971 | 7 | |
| 1972 | 3 | Total = 26 |

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[1] See Appendix Q.(ii)

[2] See Chapter 14.

[3] The Schools Council, Working Paper No.10. "Curriculum Development Teachers' Groups and Centres." 1967

[4] See p. 7.03.

Of the 26 centres, 18 were staffed by full time wardens and 8 by part-time wardens. 7 of these had primary school experience, 9 had secondary experience (3 in science), one came from adult education and, for the remainder, no information was given.

The science background of the warden did not appear to influence the programme of the centre in this small sample.

Table 12.3. Teachers' centre time for secondary education

| No. of centres | Percentage of time spent on programmes for secondary teachers |
|---|---|
| 5 | none |
| 7 | 5 - 20% |
| 4 | 25 - 35% |
| 4 | 36 - 45% |
| 4 | 46 - 50% |
| 1 | 90% |
| 1 | no information |

The centres were obviously used more extensively for primary school work, but half of them provided more than 25% of the programme for secondary teachers. However, in only one authority did the time given to secondary school science in a multipurpose centre exceed 5% of the total programme:

Table 12.4

| No. of centres | Percentage of total programme given to 11+ science. | |
|---|---|---|
| 13 | none | |
| 9 | 0 - 5 | |
| 1 | 6 - 10 | |
| 1 | 40 | special science centres within one LEA. |
| 1 | 90 | |

It appears, therefore, that secondary school science teachers, in these twelve local authorities, do not usually meet in the same centre as do teachers in other subject areas. In general it seems that the authorities are content for other agencies to provide the raison d'etre for science teachers to come together.

However, in seven areas in the sample local groups of science teachers are said to meet regularly. These groups are not attached to the ASE and meetings are attended by representatives of the LEA. In the answers to the questionnaire it is not clear whether these group meetings are additional to those organized by the LEA termly (in 5 authorities), or more often (in 6 authorities), for science teachers below head of department level. All twelve authorities claim to bring heads of science departments together at least once a year.

(b) Alternative centres of support for science teachers.

Since the publishing of the first of the Nuffield Science Teaching materials in 1966 there has been an unprecedented expansion of interest in science education in the universities and professional societies. This has been institutionalized in the creation of Chairs in Science Education e.g. at Chelsea College, London University, and at Leeds University. A chair in Chemical Education was created at East Anglia and one in Biological Education at Bath. In addition Teachers' Centres, as those in association with the Royal Institute of Chemistry and similar Physics and Biology Centres have been established and have sometimes developed into Science Centres. In many cases these latter have been additional to the existing science departments in Colleges and Departments of Education, and together form a complex and largely uncoordinated background of support for science teachers.[1]

The local authorities were asked to name, in order of importance, any centres or institutions organizing meetings or courses for science teachers that were accessible to teachers in their area.

The pattern of use appears to vary with the regional position of the authority:

in the London area

all four use the Centre for Science Education, Chelsea,
two use other Universities,
two use Polytechnics,
only one uses the Institute of Education;

in the Home Counties use is made of
the local university's Teachers' Centre,
the local university's Education Department,
the local college of education;

in the Midlands the teachers use
the School of Education at the local university,
the colleges of education,
the science departments at the university;

in the North they use
the colleges of education,
the universities;

in Wales the authority mentions
the University of Wales,
the colleges of education.

The colleges of education, though numerous in London, are seen to have little value for science education in the area, but assume more importance further north in the country.

Between them the twelve authorities mentioned 29 institutions and in view of this provision of support elsewhere, they may feel that additional meetings and courses provided by the LEA are unnecessary. Indeed the expectation that science courses would be provided by the university centres or within the A.T.O. organization was expressed more than once in the original interviews with local authorities.

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1. See "Support for School Science and Technology": Schools Council Working Paper No. 38, 1971.

However, many teachers within this sample of 12 LEAs[1] tended to dismiss the influence of other institutions: two thirds of those using projects were of the opinion that "the activities of other institutions" had no effect on their use of a specific project. Only 25% reported that they had a facilitating effect.

Meetings and courses organized by other bodies were apparent to the LEA officers, but when teachers were asked about their attendance at these, a less satisfactory state of affairs was revealed:

Table 12.5

| Organizing body | Mean response[2] N = 195 | % not attending |
|---|---|---|
| your LEA | 1.9 | 32.8 |
| specialist subject association (e.g. ASE) | 1.8 | 40.4 |
| university | 1.7 | 38.8 |
| teachers' professional association | 1.6 | 59.0 |
| other higher or further education institution | 1.6 | 51.3 |
| examinations board | 1.5 | 65.3 |
| professional centre (e.g. RIC, Bio.Centre) | 1.5 | 63.4 |
| Department of Education and Science | 1.3 | 71.5 |

In no case did the mean ever reach the "attend a few" category, but, interestingly, meetings organized by the LEA emerge as marginally more often attended than those of other bodies, with the ASE and University following closely.

The question was so worded that teachers were led to respond relative to their awareness of the total provision of meetings and courses organized by the bodies. As they were asked how often they were able to attend, the low mean indicates a perceived restriction on attendance. But overall, more attend activities organized by the LEA than by other bodies. Several factors may operate here: a shorter journey may be involved, a greater proportion of the cost may be borne by the authority or it may be that activities organized by the employing authority fall more frequently within a teacher's perceived definition of legitimate limits to his "job". LEAs are sometimes reluctant to add the weight of their authority to curricular activities - either by organizing them or by associating with other bodies. These results suggest that education authorities should consider carefully the extra relevance that LEA activities may have for teachers.

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[1] Teacher questionnaire study (12 LEA sample).

[2] The categories of response were:
4 = attend all or most
3 = attend many
2 = attend a few
1 = do not attend

## (c) Key persons

Each of the twelve authorities mentioned at least one person with some responsibility for science at the advisory level in 1973. All of these posts had been created in the last ten years and all but three of them since the publication of the first of the Nuffield Science Teaching Materials. That this is a common pattern of expansion, at least in England, is shown by the following data.[1]

Table 12.6. Showing increase in advisory personnel from 1966 to 1973

| | Science Advisers 1966/67 to 1973/4 | No. of LEAs increasing advisory personnel | More than doubling advisory personnel |
|---|---|---|---|
| Counties (44) | 6 → 19 | 13 | 10 |
| County boroughs (79) | 5 → 22 | 11 | 13 |
| London boroughs (20) | 7 → 13 | 3 | 3 |
| Wales (county) (13) | 0 → 2 | 5 | 2 |
| (bor.) ( 4) | 0 → 1 | 1 | - |

(These figures do not include those few authorities who appoint general advisers/inspectors with part special subject responsibility, but do not reveal this in the statistics used.)

Several LEAs have added advisers in other areas of the curriculum also, some more than doubling the total advisory personnel in a period of seven years. A few have appointed a special curriculum development officer.

But in some authorities the position of science adviser has been created without corresponding posts in other areas of the curriculum. This perhaps is an indication of response to the pressure on authorities created by the Nuffield projects and not necessarily part of a planned development arising from "task 11" of the LEA.[2]

One might argue that the "curriculum explosion" and other changes of the sixties, with associated demands on resources and in-service training, has required the LEAs to assume a more active responsibility for the curriculum acknowledged by the employment of "curriculum" personnel at the authority level rather than in the schools.

The advisory personnel in our sample were variously described and the time each spent on science ranged from 1% to 100%.

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1. Education Committee's Year Books 1966-7 and 1973-4
2. See discussion p. 9.04.

Table 12.7

| Range of time spent on science | No. of advisers spending this time |
|---|---|
| 0 - 5% | 4 |
| 10% | 1 |
| 30 - 40% | 1 |
| 50% | 5 |
| 70% | 1 |
| 100% | 2 |

One authority mentioned an organizer for secondary schools as responsible for science(and presumably for all other subject areas of the curriculum), but gave no time allocation for science. A similar general responsibility is probable for those quoting 10% or less time spent on science. In three of the authorities the post carried advisory responsibility for mathematics also. The perceived role of the adviser in science was considered of such potential importance in the communication-support system that a study of it was developed further.

(continued on p. 12.07)

12.07

All twelve of the authorities were able to identify at least one other person in the area who was important for science education there.

5 authorities identified 3 or more persons
3 authorities identified 2 persons
4 authorities identified 1 person

These persons fell into the following categories:

Table 12.8

| Persons mentioned | No. of LEAs making mention |
|---|---|
| HMIs | 8 |
| University staff (Department of Education mainly) | 4 |
| College of Education (science tutors) | 3 |
| Project team members | 3 |
| Science Centre staff | 2 |
| Teachers | 2 |
| Schools Council Field Officer | 1 |

Significantly those whose appointment carried responsibility for science education - the HMIs and science centre staff - were seen to be influential. The Schools Council Field Officers are so sparsely distributed that it is not surprising that their influence was detected in only one of our small sample. Department and College of Education tutors, with school contacts arising from teaching practice and in-service courses, were important in only half of our sample. One questions how far the hopes of the Schools Council[1] that these institutions will increase support for the work of the teachers and the local education authorities is being fulfilled.

When the teachers were asked to indicate how often they consulted with various categories of person for information[2] a discouraging picture emerged:

Table 12.9

| Persons with whom teachers may consult for information | Mean frequency | % saying never |
|---|---|---|
| Science teachers from your own school | 4.5 | 0.5 |
| Science teachers from other schools | 2.9 | 11.3 |
| Your head teacher | 2.5 | 27.2 |
| University staff | 2.0 | 43.6 |
| LEA science advisers/inspectors | 1.9 | 50.0 |
| Staff of other higher education institutions | 1.9 | 44.8 |
| Teachers' Centre staff | 1.7 | 54.3 |
| Teachers from curriculum project trials | 1.6 | 58.5 |
| Staff from curriculum project trials | 1.4 | 70.6 |
| HMIs | 1.4 | 67.0 |
| Schools Council Field Officers | 1.1 | 93.8 |

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[1] Working Paper No. 10

[2] Teacher questionnaire study: 5 = regularly, 4 = often, 3 = occasionally, 2 = seldom, 1 = never.

From this it appears that teachers seldom to never consult with HMIs or persons involved in curriculum development trials, seldom talk to LEA advisers or university staff and only occasionally with science teachers from other schools, when they seek information. On the other hand they consult with science colleagues in their own school "regularly" and "often". It is possible that relative to the frequency of these consultations, those with other persons outside the schools seldom take place. But if the teachers' responses represent, with some validity, the frequency of contacts that potentially provide opportunities to discuss science education (and there may be doubt here as the question referred only to consultation for information), then the possible influence from these persons is slight.

The sense of isolation coming from the teachers' responses was apparent in only one of the LEAs' replies - "There seems to be nobody with any real influence; there are no colleges in the area, HMIs visit only rarely; the two technical colleges are beginning to offer more help."

The "effective local leadership" from among the teachers themselves anticipated by the Schools Council[1] does not appear to be visible to the LEA administrators. Only two made reference to teachers in this context - one after four other categories of person had been mentioned. The other - a largely rural area, with no specialist advisory staff - made first mention of a local teachers group which had recently revived under the leadership of a local head of science. It is possible that in an area well-served by persons outside the schools, with responsibilities in science education, the teacher may experience fewer demands on himself to assume leadership.

No person identified with the ASE was mentioned by the authorities. It is apparent that the importance of the Association as an information source (see later) is not displayed in its local activities in these areas.

### (d) Industrial links

In spite of recent attempts to relate technology to the work of the schools only one authority claims that a high level of contact exists between its schools and local industries. Five claim moderate links, three think they are low, two do not know and one did not reply. Seven authorities were located in high density industrial areas, but only four had formal links involving a "link-man" based in industry. No local person from industry was mentioned as being influential in science education - the orientation of school science appears still to be academic rather than technological.

### (e) Communication

The authorities were asked twice about the communication of science curricular information to teachers: first, in a general way, they were asked to rank 7 methods of communication from the LEA to the schools, and, later in the questionnaire, they were asked to rank 6 statements of how they expect teachers to get to know about national curriculum development projects.

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[1] Working Paper No. 10

Table 12.10

| Communication from Education Office to schools | Mean Ranking |
|---|---|
| letter to head teacher | 2.2 |
| visit by inspector/adviser | 2.5 |
| general bulletin | 3.2 |
| special curriculum bulletin | 3.3 |
| telephone to head of science | 4.3 |
| through teachers' centre | 4.4 |
| telephone to head teacher | 5.1 |

Table 12.11

| Expected method used by teachers for National curriculum development projects | Mean Ranking |
|---|---|
| through advisory service | 1.5 |
| direct from Schools Council or other body | 2.9 |
| by teacher's own efforts | 3.5 |
| through teachers' centres | 3.7 |
| LEA's contacts with head teacher | 4.1 |
| from professional organizations | 5.2 |

These responses indicate that while the customary procedure for information from office to school was for it to pass via the head teacher (8 ranked this in first place), the authority did not see this as effective in establishing teachers' familiarity with curriculum development projects in science. Teachers' responses[1] support this in that they reported they seldom to occasionally consult with head teachers for information, whereas 63% of the head teachers[2] found their heads of departments very useful sources of information. Both sets of LEA responses showed a heavy reliance on the communication channel role of the advisory service. 31% of the head teachers[2] reported that the LEA adviser was a very important source of information and this emerged also in both the authorities' and the teachers' responses to statements about the role of the adviser.[3]

All the authorities made use of the general bulletin, but without great conviction, placing this in the middle ranks. Two gave priority to a special curriculum bulletin, but this was possibly not a real alternative for most, who ranked it last, one mentioning that it was "not allowed".

Only one authority gave top rank to teachers' centres as a means of disseminating information, and that oddly, as its centres offered only 1% or 5% of time to secondary school science.

The LEAs ranked teachers' professional associations as the least useful of the six information sources to teachers. However, the teachers ranked as most useful the publications of one of these - the ASE -

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1. Teacher questionnaire (12 LEA study)
2. Head teacher questionnaire, 8% National sample
3. See Chapter 13.

while the LEA adviser/inspector emerged as the eighth most useful when they were asked[1] to rank up to five of the most useful sources of information about curriculum development projects from a list of 34 types of publication, persons and meetings or courses organized by various bodies. The overall ranked positions and weighted scores are given in Table 12.12 for those sources that occurred in the top half after analysis.

Table 12.12. Reported usefulness of sources of information by teachers in 12 LEAs.

| Overall Ranked Position | Weighted Score | Source of information about curriculum development projects | Type of source |
|---|---|---|---|
| 1 | 399 | A.S.E. publications | publication |
| 2 | 238 | science teachers in own school | person |
| 3 | 187 | Times Ed. Supplement | publication |
| 4 | 175 | science teachers from other schools | person |
| 5 | 124 | circulars from C.D.P.s | publication |
| 6 | 118 | information from publishers | publication |
| 7 | 112 | science journals and magazines | publication |
| 8 | 103 | LEA advisers/inspectors | person |
| 9 | 93 | LEA | meeting |
| 10 | 81 | specialist subject association | meeting |
| 11= | 73 | other special subject journal | publication |
| 11= | 73 | other educational journals | publication |
| 13 | 68 | LEA circulars | publication |
| 14 | 63 | professional centre | meeting |
| 15 | 53 | university | meeting |
| 16= | 51 | other higher or further education institutions | meeting |
| 16= | 51 | teachers from trial schools | person |

Although 31% of the teachers claimed they "seldom" or "never" read the publications of the A.S.E., those who did found them very much more useful sources of information about projects than the other agencies quoted. As might be expected from the frequency of consultation, their own school colleagues were also useful sources. Then followed the "Times Educational Supplement" and "science teachers from other schools". The relatively high ranking of the former showed an interesting difference from the results of the pilot questionnaire study, where the T.E.S. had a similar high mean of use - read "occasionally" to "often" - but was seen as one of the least useful sources of information about projects. It may be that the teacher sample in the pilot differed from that of the main study. On the other hand, although no statistical analysis has been carried out, a subjective impression of several persons familiar with the T.E.S. is that recently it has contained more curricular reporting, so that teachers, nearly two years later, may indeed have found it a more useful source of information.

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[1] Teacher questionnaire (12 LEA sample)

Three other types of publications clustered in fifth to seventh places: circulars from curriculum development projects (these may come via the LEA or from teachers' own efforts in making contact with the project developers), information from publishers (which may be sent direct to the school or, for members, be enclosed with publications from the ASE) and science journals and magazines. Together these 7 sources accounted for 53.6% of the weighted score.

The preponderance of publication sources over personal ones (5 out of the first 7) reflected the greater frequency of use of these.

Table 12.13

| Publications | "Frequency"[1] mean | % never reading |
|---|---|---|
| scientific supply catalogues | 3.6 | 6.7 |
| science journals and magazines | 3.5 | 2.5 |
| LEA circulars | 3.4 | 9.2 |
| Times Educational Supplement | 3.4 | 9.2 |
| information from publishers | 3.4 | 8.7 |
| publications of the ASE | 3.3 | 12.9 |
| other specialist subject journals | 3.1 | 10.4 |

Of the remaining publication sources 5 had a mean between 3 and 2 while in only one did the mean fall below the "seldom" level (Schools Council "Project Profiles and Index"). For personal sources (Table 12.9) only the one occurring second in the "useful" list - "science teachers from your own school" - had a mean use above "occasionally" (=3), while more than half showed a mean below "seldom" (=2).

Although teachers only seldom to occasionally read circulars from curriculum development projects, they are totally informative, so achieve a relatively high level of usefulness. These, together with the Schools Council's "Dialogue" form the most useful publication sources for head teachers[2], following the heads of departments in their schools. Overall, both head and teacher replies indicate that the flow of information is from the teacher to the head and not vice versa.

Comparisons of Tables 12.10, 12.12 and 12.13 suggest that if science teachers report correctly that they read the LEA bulletin more often than the publications of the ASE then the former could be used with more confidence than at present by the local authority to convey information to the teacher.

It was shown earlier (Table 12.5) that the teachers reported they attended meetings organized by the LEA rather less infrequently than those by other agencies and yet LEA meetings appear as the third in order of usefulness in the "meetings" category.

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1. Teacher questionnaire study: 5 = regularly, 4 = often, 3 = occasionally, 2 = seldom, 1 = never.

2. Head teacher questionnaire, 8% National sample.

The LEA's perception of the value of the adviser in disseminating information about projects would have greater validity if circumstances enabled the teacher to meet with him more frequently, for in spite of consultations seldomly occurring the adviser/inspector is the most effective personal source after science teachers.

It could be argued that by more confident use of the bulletin or the production of special circulars, by ensuring that information was regularly and clearly displayed at local meetings of science teachers and by increasing the opportunities for advisers and teachers to meet, the LEA could become a more effective bridge between national curriculum projects and the teacher.

It is significant in this context that the "availability of information about a project" was perceived by the teachers as the second most important facilitating factor in the use of projects by both adopting and rejecting teachers.[1]

### (f) Response to curriculum development projects.

Our enquiry encountered a severe limitation when we attempted to discover the local authorities' responses to curriculum development projects in the form of provision of trial schools, finance and in-service courses for teachers. In the majority of cases records had not been preserved and many personnel had been appointed later than the development and early diffusion stage of the initial projects.

#### (i) Trial schools

Three of the 12 authorities could provide no information at all as to whether an approach had been made for a trial school to be established in their area for any of 16 science projects, and what their reaction had been to any such approach, although other records had shown one to have had a maintained school in O-level Biology trials and in another several schools participated in the development of Secondary Science material.

Information about the more recent projects - Secondary Science and SCISP - was more forthcoming and more areas claimed to have trial schools for these. This difference between early and later projects may reflect the different strategies of the project developers: the early ones tended to approach first the schools and then the authority, while the later procedure has been to make the initial request of the LEA. Further, with the expansion of the dissemination stage of projects, more schools have been involved at this stage.

Several replies indicated that the authorities had not been invited to support trials for some of the projects, and this may be so, but one claimed it had not been approached for any one of the 16 projects, which appears unlikely.

A few LEAs claim to have taken the initiative where a particular project is concerned, but the usual pattern is to respond - by acceptance or rejection - to the approach from the development team.

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[1] Teacher questionnaire study. (17 LEA sample)

However, two of the authorities that have been active in recent trials and have a high proportion of schools using the earlier projects claimed trial schools in the latter, where other records showed none existed. There may be confusion here between early take-up and trials (both persons reporting had been appointed after publication of the early projects).

Only one of the nine respondents reported rejecting requests for trial schools and this gave no reason for the rejection, so that no information was forthcoming from any authority to indicate at which level - authority, head teacher or teacher - that the rejection had been made.

The reported procedure for one LEA is available elsewhere.[1]

> "Following..... the receipt of the normal letter from the Schools Council inviting LEA participation in a suitable project, schools are circularized and volunteers sought for nomination. Invariably there is over-subscription despite the fact that by now it is well known that involvement with projects generally creates a great deal of extra work for schools and staff. Where the original Schools Council letter merely asks for the names of schools where good practice in some particular area of the curriculum is considered to exist, nomination is agreed by the teachers concerned, though sometimes in this situation with some diffidence."

This article does not make clear who judges the suitability of projects and assumes consensus among teachers operates in nomination.

In only one case were reports made back to the committee for schools to adopt the materials after trials, this being in the area of most intensive use of projects, where development and financial support were carefully planned.

(ii) Financial support.

Eight of the 12 LEAs in our sample replied that the Education Committees had been asked to provide financial support for trials, and that they gave all the help requested. In no case was the need to economize an important obstacle. If, as this suggests, Education Committees tend to support requests put to them for special curriculum projects, then the question remains as to whether the Education officers present only selective requests of an order that will meet with committee approval.

One authority reported a policy of itemizing requests for project support, as the councillors were more reluctant to cut out particular items than to trim a global sum.

All LEAs in the sample were asked to quote the sums specially allocated to support curriculum projects in the schools in science and in other areas of the curriculum in each of the years 1964-1972. Two authorities provided no information, one reported "finance raised as required" but made no indication of the sums (if any) raised, while a third had adjusted its financial arrangements so that a sum, extra to capitation, was allocated to each school as part of an "alternative use of resources" scheme. For the eight responding LEAs the figures for science are as shown.

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[1] J. C. Dunn "Schools Council projects and self-renewal for teachers" Education, November 1973.

Table 12.14

| LEA No. | Size category | Sums in thousand pounds given to science (to other curriculum area in brackets below) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
| 8 | S | | | | | | | | | 12.0 |
| 11 | SM | | | | | | | 4.9 | 3.5 | 3.5 |
| 12 | SM | | | | | 3.0 | 3.5 | 4.0<br>(1.0) | 5.0<br>(2.5) | 6.0<br>(4.4) |
| 7 | M | | | | 3.0 | 3.5 | 3.5 | 3.0<br>(0.5) | 3.5<br>(1.5) | 4.5<br>(2.0) |
| 2 | M | | | | | 20.0 | 15.5 | 15.0 | 10.0 | 10.0* |
| 1 | ML | | | | | 4.8 | 6.5 | 8.3 | 19.2 | 10.5 |
| 5 | L | | | 15.0 | 15.0 | 22.0 | 22.0 | 28.0 | 22.0 | 26.0 |
| 9 | L | | | | | | | | 10.0 | 34.0<br>(very much less) |

(*These sums represent all extra money for science programmes and includes that given to newly-created comprehensive schools to develop sixth form work where this had not existed previously.)

In only two cases were figures quoted for other areas of the curriculum and these show a later start with support running at a lower level which reflects the later and possibly lower demands of projects in these areas.

For the teachers the availability of special grants to launch a project and money to keep it going were very important factors. Of the adopters of projects only 12.9% reported the former and 18.9% the latter as having no effect on their use of a project.

The mean for the former was 3.2[1] indicating that more than half the remaining responders found the grants they received were facilitating while others were implementing the project in spite of the perceived inadequacy of financial support. For the availability of money to maintain a project the mean was 2.9, only slightly on the limiting side.

A higher proportion - 40.0% and 44.2% - of rejecters of projects reported that the availability of money had no effect, but the means were both on the limiting side: 2.6 for each, although not the most limiting of the factors included.

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[1] Teacher questionnaire study: 5 = strongly facilitating, 4 = facilitating, 3 = no influence, 2 = limiting, 1 = strongly limiting.

For the head teachers[1] only the work-load of their staff and inadequacy of accommodation were reported as more limiting factors than the availability of grants both to launch and maintain a project.

Discussions with schools had revealed irritation in some places caused by inflexible financial controls: two or three years elapsing before requested funds became available, restrictions on suppliers to be used for apparatus and small petty cash allowances. These last two factors were found particularly irritating by teachers who were able and willing to make up their own pieces of apparatus and hence make some use of a project in the absence of adequate special support.

When the LEAs were asked about these restrictions, it appeared that special funds for curriculum projects were more readily accessible than those for "capital" items - six authorities required only 6 months notice, while 5 required 12 months. For capital items the following variation was found:

| Time elapsing before approved "capital" funds become available | Number of authorities |
|---|---|
| 6 months | 3 |
| 12 months | 8 |
| 24 months | 1 |

In most cases therefore the time interval appears a reasonable one and to require forward planning and preparation from science departments, creating problems only when staff turn-over is high.

Two out of the twelve authorities made a restriction on suppliers, three on the purchase of surplus equipment, while another limited the purchase of "consumables" in science to £25 in any one year.

The petty cash limitations were variable and were reported thus:

| Petty cash limit per item | No. LEAs reporting |
|---|---|
| postage only | 1 |
| £2 | 3 |
| £2 - £5 | 1 |
| £5 | 2 |
| £6 | 1 |
| £10 | 2 |
| no limit | 1 |
| no reply | 1 |

The CEO reporting no limit to petty cash also reported no restrictions in the other factors discussed. This was in an area where teachers were most resentful of restrictions and suggests the CEO was not aware of the limitations imposed on the schools by the Treasurer's department.

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[1] Head teacher questionnaire: 8% National sample.

### (iii) Provision of in-service courses

The LEAs in the sample were asked to give the number of in-service courses they had organized each year from 1968.

Table 2.15

| | Number of courses held in each LEA† | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | LEA No. | | | | | | | | | |
| | 1 | 2 | 3 | 5 | 6 | 7 | 9 | 10 | 11 | 12 |
| O-level Biology | | | 9 | 4 | | | | | | 3 |
| Chemistry | | | 5 | | | | | 3 | | 3 |
| Physics | | | | | | | | 2 | | 3 |
| Combined Science | | | 5 | 1 | 1 | 2 | | | | 2 |
| Secondary Science | | 1 | 2 | 1 | 6 | 2 | | 2 | | 3 |
| SCISP | 1 | | | | | | | | | 1 |
| Science 5-13 | | | | 3 | 22* | 4 | | | 1 | 1 |
| Project Technology | | | | | 6 | | 1 | | | |
| LEA size category | ML | M | ML | L | M | M | S | L | SM | SM |

† 2 LEAs could provide no information.

* These were general primary teachers' courses in which the philosophy and methods of Science 5-13 were presented.

In addition to these, 4 LEAs (2, 3, 5 and 10) had run some courses for the A-level projects, and LEA 6 had held two courses for Environmental Studies and two for Project Environment. Only 6 of these LEAs had made any attempt to provide a range of courses. Two of these had obviously concentrated on the projects for the younger and less able pupils. LEAs 5 and 12 were high users of projects but although LEA 3 had run courses for O-level Biology for 4 years and chemistry over 3 years, by 1973 it had only one school entering candidates for a Nuffield examination and that in Physics!

Several authorities staffed courses with their own teachers who had become familiar with materials by working in trial schools or attending national courses. These were supplemented by advisory staff, HMIs and College of Education tutors.

When asked which of five methods they would use to enable teachers to become proficient in implementing projects after publication, four of the LEAs did not reply - (2 would use all methods as appropriate but had provided only 3 and 1 courses respectively). Of the remaining 8, five would concentrate on "setting up courses and encouraging teachers to participate in them"; of these, three ranked as last alternative the "waiting for teachers to ask for courses". Three of the four small LEAs would prefer to "inform teachers of courses available elsewhere and offer support", but as second choice would wait for teachers to ask for time off and support to attend courses elsewhere. Two saw visits to trial schools as back-up to their own courses, but three saw little value in these, ranking them last. Two-thirds of the authorities preferred to run courses during the day, but one third held most in the evenings. All but one (a rural area) placed residential courses last, two (urban) saying they would never hold them.

### (iv) Support for in-service courses

The teachers rated LEA support for courses one of the highest facilitating factors for the use of a project[1] (though 30% of "adopters" and 43% of "rejecters" said it had no effect). Three of the twelve LEAs claimed to offer teachers full support for travel, tuition and accommodation for all courses attended if approval from CEO or, in some cases, an Inspector had been obtained. Two provided 75% of all expenses, two 50% costs and three travel less 50d, while one gave full travel but half accommodation. Others did not give full support but did not quote proportion provided. It is apparent that for in-service courses many teachers have to dip into their own pockets for some part of the cost.

## (g) Special problems

### (i) Local government reorganization

Four of our sample LEAs had been newly established in 1965 consequent upon the reorganization of London boroughs. The remaining eight experienced considerable changes in 1974. Few of these anticipated in 1973 that this would affect curriculum development appreciably and certainly teachers in the case study schools judged its effect would be minimal. Head teachers in the 8% sample reported reorganization of LEA boundaries likely to have little influence on future changes in the curriculum. However, one authority reported that it had experimented with the use of teacher-advisers in mathematics and would have gone on to make similar appointments in science for 1973/4 but for the changes imminent in the LEA, while another also reported a "delay in the making of decisions". One of the four London boroughs commented that there had been a slowing down of the development of new ideas and the adoption of projects in the years immediately following reorganization.

The nation-wide reorganization had taken place during the last year of this research project and in spite of the interest shown in it by the co-operating LEAs, the courtesy of their officers and their willingness to help, it became apparent, as April 1974 approached, that the pressure of planning and extra work associated with the change made the meeting of our requests for information increasingly more difficult.

Reorganization has been accompanied by the creation of new posts, the appointment of new personnel, the development of new procedures and the appearance of colleagues fulfilling similar functions. It is inevitable that LEA initiative in curriculum development will be withdrawn to some extent while relationships are established and the potentials of the new situation are explored. LEA initiative and the activities of the advisory service are seen by the head teachers[2] as the factors most highly facilitating the use of projects in their schools. There may be, therefore, some loss of momentum in the reorganized areas. On the other hand where the change has been accompanied by the creation in the enlarged LEA units of advisory posts, that did not previously exist, there may be an increase in LEA initiative in curriculum development.

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[1] Teacher questionnaire study. (12 LEA study)

[2] Head teacher questionnaire: 8% national sample.

## (ii) Comprehensive reorganization

The effects of comprehensive reorganization on the use of projects by schools has been complex. Shipman[1] lists among salient points identifying a school which is likely successfully to introduce and implement a planned innovation the freedom from any immediate need to reorganize as part of a changing local school structure.

All 12 of our LEAs had planned some form of comprehensive system of secondary schools by the autumn of 1973. Six had implemented changes early, in five they were phased over several years, while one initiated changes only in September 1973.

Three authorities, in which the grammar schools persisted until recently, became relatively high users of the Nuffield O-level projects, while two of the early developers of comprehensive schools suggested that the low use of these projects in their schools arose from their preoccupation with problems of reorganization when these projects became available. One school in the latter group went on to say that their attention was focussed at the time on the less able child; in the absence of a national project they developed their own courses which were in use by the time Secondary Science was published, thus leading to their non-use of this.

The Head teachers[2] saw comprehensive reorganization as the development most significant for future changes in the curriculum (with ROSLA a close second). 60% of this sample had been, or were about to be, reorganized and judged the overall effect as encouraging the use of projects - (the means of three items were on the facilitating side of "no effect") - but where there had been uncertainty about a school's future, or more than one change in the status of a school during reorganization, then the effect had been to limit new developments.

Although approximately half of the science teachers[3] reported that the use of projects was unaffected by secondary reorganization, for the remainder it had a limiting effect for both adopters and rejecters.

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[1] Shipman M.D. "The impact of a curriculum project"

[2] Head teacher questionnaire: 8% national sample.

[3] Teacher questionnaire study. (17 LEA study)

The resulting comprehensive systems that had emerged in the 12 LEAs were varied:

Table 12.16

| Type of System | Age range of pupils in the schools by LEA | Comments |
|---|---|---|
| "all-through" | 11-18; | with some separate but linked lower and upper schools |
| | 11-18; | but senior and junior non-linked schools operated for six years. |
| | 11-18;<br>11-18; | but a few selective schools remain |
| tiered | 8-12, 12-18;<br>10, 11-14, 14-18; | grammar schools became upper schools |
| | 9-13, 13-18; | grammar schools and some modern schools became upper schools |
| | 11-16, 16-18; | sixth form colleges follow 11-16 schools |
| mixed | 12-16, 12-18; | with transfer at 16+ if desired |
| | 11-16, 11-18; | with transfer at 13+ or 16+ if desired |
| | 11-14, 11-16, 11-18 | with transfer at 14+ or 16+ if necessary |
| | 11-14, 11-16, 11-18, one 16-18 | with transfer at 14+ or 16+ if necessary |

The great variety in organization revealed within even this small sample of local education authorities indicates both the difficulty of implementing any curriculum materials interpreted by the teacher as a "package" and the inescapable need to modify, at the local level, materials developed in any national curriculum project.

One result frequently accompanying comprehensive reorganization at a time of national support for science has been the provision of new laboratories in the reorganized schools. Where this has happened the science department may have experienced initial inconvenience at the building stage and the head of science demands on his time and energy in planning their use, but it provided the opportunity to purchase new apparatus and hence to acquire the apparatus developed for national projects without the request for special grants.

The LEAs were asked to give details of the number of new laboratories that had been provided in their areas in the interval 1964-72. Eight of them did so:

Table 2.17 Number of new or renovated laboratories in LEA schools in the period 1964-72

| | Number of laboratories | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| LEA No. | 2 | 3 | 5 | 7 | 9 | 10 | 11 | 12 |
| No. labs. in new schools | 16 | 5 | 52 | 8 | 2 | 0 | 0 | 8 |
| No. new labs. in existing schools | 31 | 27 | 43 | 46 | 17 | 7 | 49 | 44 |
| No. renovated labs. | 8 | 2 | 18 | 0 | 0 | 5 | 0 | 7 |
| Size of LEA | M | ML | L | M | S | L | SM | SM |

These figures indicate a considerable expansion of accommodation for science teaching over the period, but in 1972 both head teachers[1] and teachers[2] report accommodation available had a limiting effect on the use of projects.

Table12.18 The effect of accommodation available on use of projects

| | Mean response[3] | % saying "no effect" |
|---|---|---|
| adopting teachers | 2.6 | 20.7 |
| rejecting teachers | 2.1 | 28.2 |
| head teachers | 2.4 | 10.1 |

For over a quarter of the rejecters the accommodation available in their schools appeared not to affect their decision not to use a project. The adopters' responses suggest that accommodation may have modified their use of a project. The low percentage of head teachers placing this factor in the "no effect" category suggests that a critical factor in the overall use of projects by a school may be the nature and extent of accommodation available.

### (iii) Social factors

Only one of the twelve LEAs had been designated an Educational Priority Area and its plans in this context had not included special courses for teachers.

In only two had the population remained static, while ten LEAs reported an increase. In six this had been accompanied by an increase in the number of non-nationals. Five of these authorities had appointed special teachers to help with immigrants' problems and had developed special centres. All had run courses for teachers in their area and four had run special courses for the immigrant pupils.

### (iv) Staffing

The average time teachers in our sample[2] had spent in full-time teaching was 9.2 years, reflecting the recent increase in numbers of science teachers, and the relative youth of science teachers as a whole - more than 25% of the responding teachers had completed less than three years teaching. The average length of time spent in their present post was 5.1 years, indicating a considerable period of service on the part of some teachers: 18% reported spending from 10 to 15 years in their present post.

The rate of change of staffing is very much context-bound, the LEAs reporting various rates of turnover:

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1. Head teacher questionnaire: 8% national sample
2. Teacher questionnaire study. (17 LEA study)
3. 5 = strongly facilitating, 4 = facilitating, 3 = no effect, 2 = limiting, 1 = strongly limiting

Table 12.19 Turnover of teaching staff

| LEA Number | Type of LEA | % turnover (all teachers) | Comparative turnover of science teachers |
|---|---|---|---|
| 11 | County | under 10% | approximately the same |
| 4 | London Borough | 10 - 19% | " |
| 6 | County | " | " |
| 8 | County Borough | " | " |
| 9 | " " | " | " |
| 10 | " " | " | " |
| 12 | London Borough | " | " |
| 1 | " " | 20 - 29% | higher |
| 2 | " " | 30% or more | approximately the same |

Shipman[1], studying the trial stage of the Keele Integrated Studies Project, concludes "staff turnover, while not significantly related to failure to complete the trial, was significant.... in determining the extent and persistence of curriculum change. Loss of staff on any scale stopped innovation."

44% of the head teachers[2] in our sample reported that staff turnover had no effect on the use of projects, but the mean response was marginally limiting. Of the teachers, 57% of the adopters and 59% of the rejecters said it had no effect, but the means 2.7 and 2.6 respectively[3] showed that in some schools the turnover of teaching staff inhibited the use of projects.

It is mainly the large urban authorities that are faced with this staffing problem, and a recent directive[4] to head teachers from the CEO of the ILEA shows an awareness of its effect on curriculum developments.

### (v) Travel

Three factors appear to contribute to problems here:

(a) in rural areas where the distances teachers may have to travel to meetings or non-residential courses is large, sometimes as much as 20 miles. Two rural areas in our sample quoted 5 - 10 miles average distancing of schools from centres, while two reported 10 - 15 miles.

(b) teachers in large urban areas may find traffic and public transport problems inhibits their attendance at meetings,

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[1] See Shipman (1973)

[2] Head teacher questionnaire: 8% national sample.

[3] Teacher questionnaire study: 5 = strongly facilitating, 4 = facilitating, 3 = no influence, 2 = limiting, 1 = strongly limiting.

[4] 'Times Educational Supplement'.

(b) (contd.)

for an 8 mile journey may take more than an hour to complete.

(c) The sense of insularity that may develop within small urban communities or isolated areas of a large county authority, where commuting is not extensive and geographically adjacent areas may be psychologically distant.

The overall effect is the discouragement of all but the most committed teachers from attendance at meetings involving the need to travel, especially when these occur at the end of a school day.

The data discussed above, although incomplete for many items, is used in Chapter 14 in an attempt to arrive at a communication-support index for each LEA sample. Meanwhile the further study of the Science Advisers is reported in Chapter 13.

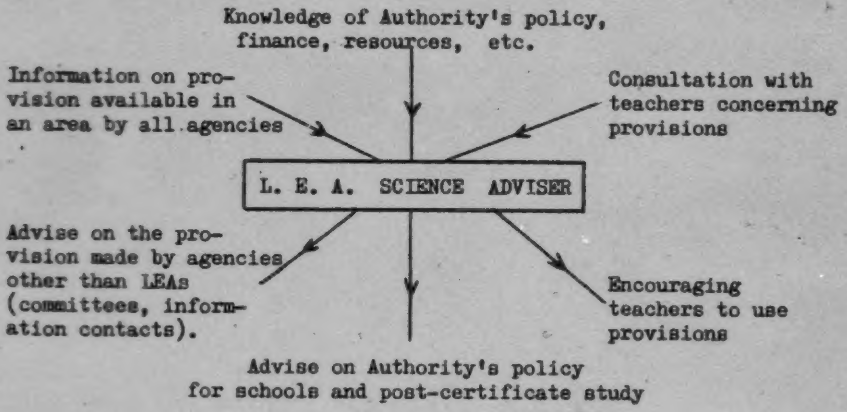
## CHAPTER 13

## SCIENCE ADVISER STUDY

There has been little public discussion of the role of the LEA subject adviser. Within the larger authorities, which have appointed school inspectors for many years, it is likely that their local role parallelled the national role of the HMIs and, indeed, several still appoint general inspectors with a sub-area responsibility for all schools, but with a specialist subject expertise that is called upon for the whole LEA.

Professor Eric Hoyle has initiated a study of the role of the LEA adviser as a "change agent" in curricular innovations[1], that has coincided, in time, with the latter half of this study, and so its findings are not yet generally available.

The Royal Society[2] made recommendations about the role of an adviser in science within its proposals for the training of mathematics and science graduates. The emphasis was placed on the facilitation of communications, requiring the adviser to be in close touch with the teachers, the administrators and all other "agencies" providing resources for science education. -


Knowledge of Authority's policy, finance, resources, etc.
Information on provision available in an area by all agencies
Consultation with teachers concerning provisions
L. E. A. SCIENCE ADVISER
Advise on the provision made by agencies other than LEAs (committees, information contacts).
Encouraging teachers to use provisions
Advise on Authority's policy for schools and post-certificate study

After consultation with various science advisers these role statements were modified and supplemented by others that described functions assumed by some existing advisers. The list was included in the teacher questionnaire and in the questionnaire to local authorities with a request to rate the importance of each role over a four point scale.

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1. "LEA Advisers and Educational Innovation" based at the School of Education, University of Bristol.

2. The Training of Teachers of Science and Mathematics, The Royal Society, 1972.

## The teachers' responses

Table 13.1. Teachers' mean ratings of role statements for a science adviser.

PLEASE INDICATE HOW IMPORTANT YOU
FIND OR WOULD ANTICIPATE FINDING
THE FOLLOWING ROLES OF AN LEA
SCIENCE ADVISER -

4 - very important
3 - of some importance
2 - of little importance
1 - of no importance

| | | Mean |
|---|---|---|
| 1. | To participate in the appointment of science teachers | 2.5 |
| 2. | To supervise and assess probationary science teachers | 2.8 |
| 3. | To ensure that safety regulations are fully observed in school science laboratories | 3.1 |
| 4. | To ensure that head teachers are fully informed about curriculum developments in school science | 3.4 |
| 5. | To ensure that science teachers are fully informed about curriculum developments in school science | 3.7 |
| 6. | To recognize, support and disseminate successful local developments in science teaching | 3.6 |
| 7. | To organize in-service courses in science teaching | 3.7 |
| 8. | To inform teachers of the provision of resources by the LEA and other agencies | 3.7 |
| 9. | To advise the Authority on policy and financial or other resources for school science | 3.6 |
| 10. | To consult with teachers on the provision of resources | 3.6 |
| 11. | To advise the Authority on laboratory design | 3.3 |
| 12. | To encourage teachers to use resources | 3.2 |

All but two of these statements of role emerge as important to very important in the eyes of the teacher.

Statements 5, 7 and 8 have a marginally highest rating and reflect the teacher's response to the contemporary situation, with the current ferment of curriculum development and the multiplicity of potential resources available locally to the science teacher. It is significant that teachers give maximum rating to the organizing of in-service courses by a science adviser, suggesting a demand for courses meeting local needs.

Closely following these statements in importance are 6, 9 and 10: finding out from teachers what they need, advising the Authority on policy and resources and supporting local developments. This last may be important both for the teacher who wants to know what is effective in the local area, and is likely to be related to work for the average and below average pupil, and for the teacher who is trying out new ideas and looks for recognition and support.

One interpretation of the importance assumed by these six statements is of the science teacher's felt need of an outside agency to pierce the isolation that develops within the closed community of the school, with its insistent, immediate demands. This could account, too, for the rating given to statement 12, which is unexpectedly high in view of the professional independence of teachers.

The teachers were concerned, too, that their head teachers should be kept in touch with developments in science education, but as reported earlier[1], the head teachers were most likely to regard their own staff as information sources for curriculum projects.

The advising on laboratory design and the supervision of safety requirements in schools was of some importance, but the teachers did not recognize the need for an adviser to be concerned over-much with probationary teachers, nor with the appointment of staff.

## The LEA responses

The responses of the LEA personnel completing this section of their questionnaire placed most of the statements in categories 3 or 4, indicating an overall importance to each role statement. It was decided therefore to look more closely at the statements receiving a low rating (1 or 2: of little or no importance) and the position occupied by the responder. Low ratings occurred in only four of the replies as shown:

Table 13.2. Science Adviser role statements receiving ratings 1 or 2

| Statement numbers | Position of person performing rating |
|---|---|
| 8 and 10 | Chief Education Officer |
| 1 and 11 | Director of Education |
| 1, 2 and 3 | Science Adviser |
| 1, 9 and 11 | Curriculum Development Leader (Science) |

The Curriculum Development Leader, influenced perhaps by the dimensions of his own appointment, excluded from the Science Adviser's role the authority to assist in the appointment of teachers and to advise the Authority on policy and resources and on laboratory design. In one other Authority the appointment of teachers and advising on laboratory design were not important. It is possible that in the latter case the responsibility has been solely with the architects department which makes use of D.E.S. specifications, while excluding the need for local variation.

Within the LEA in which the Science Adviser reported the schools themselves were given considerable autonomy in the appointment of staff and similarly it is probable that the supervision of probationary teachers and safety regulations were considered the professional responsibility of the head teacher and his staff also.

The low rating of statements 8 and 10 suggested that this C.E.O. did not expect his teachers to contribute to discussion relating to curriculum development or the provision of resources. This LEA, while employing a full-time Science Adviser, was a low user of curriculum projects and had the lowest response rate for the teacher questionnaire survey.

During the design of the LEA questionnaire it had become apparent that the teachers' responses were rating most of the role statements to be of high importance. It was decided therefore to require the LEA personnel to place the statements in rank order of importance. Four of the responders were not prepared to do this (they had rated all statements 3 or 4). Table 13.3 shows the responses of the remaining eight Authorities, grouped into positions held by the responders.

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[1] See Chapter 12.

Table 13.3. Ranking of Science Adviser role statements

| Position of person responding | Ranked position of statement | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | CEO or Director | | Chief Adviser | | | Science Adviser | | |
| Statement 1 | 1 | 11 | 11 | 10 | 1 | 5 | 10 | 13[1] |
| 2 | 3 | 4 | 10 | 7 | 2 | 12 | 12 | 8 |
| 3 | 7 | 5 | 9 | 2 | 11 | 9 | 11 | 7 |
| 4 | 11 | 2 | 3 | 12 | 5 | 8 | 7 | 4 |
| 5 | 2 | 1 | 2 | 8 | 4 | 3 | 1 | 1 |
| 6 | 10 | 7 | 6 | 5 | 3 | 1 | 2 | 2 |
| 7 | 6 | 6 | 5 | 4 | 6 | 2 | 4 | 5 |
| 8 | 8 | 3 | 12 | 3 | 10 | 4 | 6 | 6 |
| 9 | 5 | 8 | 1 | 1 | 7 | 6 | 5 | 11 |
| 10 | 12 | 9 | 8 | 11 | 8 | 7 | 8 | 9 |
| 11 | 4 | 12 | 4 | 9 | 9 | 11 | 3 | 12 |
| 12 | 9 | 10 | 7 | 6 | 12 | 10 | 9 | 10 |

(The responses that show 5 or more ranking positions difference in the group are underlined.)

From this it can be seen that for statements 5 and 6, followed by 7, there was most general agreement about their high importance. These, together with 8 and 9 (that have two and one low dissenters, respectively), are five of the six statements rated highest by the teachers in the 17 LEAs. It is surprising, and perhaps a cause for concern, that statement 10 "to consult with teachers on the provision of resources", high for teachers, was not ranked highly within any LEA.

There appeared to be general agreement about the relative lower importance of encouraging teachers to use resources after providing information about them (one responder, however, gave a higher rank to "encouraging to use" than to "informing about provision". This may seem illogical at first sight, but may imply the awareness that mere telling is not enough).

It was obvious, too, from the responses, that some LEAs required their Advisers (hypothetical, in most cases) to participate in the appointment of teachers, supervision of probationers and design of laboratories, while others did not.

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1. Strictly, in this case, a "Curriculum Development Leader (Science)"

## The Science Adviser's Job

As a supplement to these surveys of opinions, that gave generally high ratings to all statements, it was decided, with the co-operation of four Science Advisers[1] who agreed to keep detailed diaries of their timed activities, to study how time was spent by an Adviser in practice. Ideally the partial seasonal nature of the job required a year's study. This was not available to the project at the time of planning and, moreover, seemed a formidable request to make. However, the study covered the six month period of October to March - most of the Autumn and Spring terms of the 1973/4 school year.

### Advisers participating in the study

Adviser P. Full-time Science Adviser in a large county authority, with full-time advisory teacher assistant.

Adviser Q. General Adviser (Science) in a large urban authority, with general advisory duties for 20 schools (6 secondary and 14 primary).

Adviser R. Inspector (Science) in a very large urban authority. During the course of the study this adviser assumed general responsibility for the schools in a sub-area of the authority.

Adviser S. Adviser (Mathematics and Science) in a large county authority.[2]

The summary sheet, on which the data was entered each week and returned to the project, is shown in Appendix .

The distribution of time is shown in Table 13.4 separately for each term. For Advisers P and Q the periods were for 12 weeks in the Autumn term and 13 weeks in the Spring term. For Adviser R the corresponding periods were 5 weeks and 9 weeks, while Adviser S completed 10 weeks in the Autumn term.

The average time spent per week suggests that the combining of specialist subject and general advisory work may make high time demands on the Adviser.

Analysis of time spent in different kinds of activity as percentages of total time is displayed in Table 13.5. This shows that generally just over half of the time for each Adviser was spent in personal contacts.[3] Travelling and dealing with correspondence accounted for at least a quarter of the total time in every case, although Adviser P spent rather more time in travelling and rather less time on correspondence. Time spent alone, in planning, varied from 6.6% in one term for Adviser Q to 32.3% for Adviser R in the Spring term. The high report on this item for the latter partly accounted for his higher average time per week spent working. He maintained a high rate of personal contacts and a correspondingly lower level of attendance at lectures, meetings and of reading. It may be that events crowded out this mode of information-gathering, on the other hand the style of this Adviser may be to keep in touch through informal personal contacts.

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[1] The project is greatly indebted to these Advisers who willingly and cheerfully agreed to help in this way.

[2] With a joint subject appointment it proved too difficult for this Adviser to analyse his time into the categories required in the Science Adviser study and so his participation was not resumed after Christmas.

[3] Obtained by summing all but the first item in S.4 (ii) together with the courses and meetings totals in S.4 (iii).

**Table 13.4.** Distribution of time spent on the job for four Science Advisers

| | Time in hours | | | | | | |
|---|---|---|---|---|---|---|---|
| | Adviser P | | Adviser Q | | Adviser R | | Adviser S |
| | Autumn 12 wks | Spring 13 wks | Autumn 12 wks | Spring 13 wks | Autumn 5 wks | Spring 9 wks | Autumn 10 wks |
| **Time spent planning and advising** | | | | | | | |
| (i) on: in-service courses | 37 | 33 | 36 | 60 | 35 | 33 | 43 |
| lab. design and organization | 106 | 100 | 22 | 19 | 11 | 25½ | 38½ |
| equipment | 38½ | 42 | 9 | 38 | 4 | 15½ | 2 |
| safety | 20 | 23½ | 3 | 18 | 2½ | 6½ | 1 |
| curriculum | 54 | 51½ | 103 | 63½ | 19½ | 72½ | 84 |
| finance | 1 | 5 | 3 | 0 | 0 | 16 | ½ |
| other | 14 | 29½ | 125 | 89 | 62 | 162 | 14 |
| Total | 270½[1] | 284½[2] | 301 | 287½ | 134 | 331 | 183 |
| (ii) alone | 88½ | 92 | 40 | 55½ | 26 | 107 | 58 |
| with - | | | | | | | |
| administrators | 37½ | 48 | 35 | 29½ | 0 | 32½ | 16 |
| other advisers | 36½ | 27½ | 35 | 57 | 9½ | 29 | 27½ |
| head teachers | 22 | 10 | 76 | 52 | 23 | 76 | 15½ |
| heads of science departments | 53½ | 88 | 22 | 13 | 16 | 10½ | 19 |
| probationary teachers | 0 | 0 | 7 | 8½ | 6½ | 11 | 0 |
| other teachers | 13 | 2 | 33 | 19 | 17 | 43 | 35 |
| others | 19½ | 17 | 53 | 53 | 36 | 22 | 12 |
| Total | 270½[1] | 284½[2] | 301 | 287½ | 134 | 331 | 183 |
| (iii) **Time spent on:** travelling | 92 | 99½ | 65 | 69 | 30 | 74½ | 45 |
| course participation: for self | 13 | 0 | 10 | 0 | 0 | 34 | 0 |
| " others | 22 | 41 | 30 | 46½ | 54 | 14 | 69 |
| lectures & meetings: science | 25½ | 67½ | 33 | 71 | 8 | 3 | 44½ |
| other | 8½ | 16 | 48½ | 69 | 0 | 6 | 25½ |
| reading - science materials | 8½ | 1 | 3 | 5½ | 7½ | 3 | 9 |
| science education | 17½ | 20½ | 19½ | 27 | 0 | 4½ | 38 |
| correspondence | 36 | 45 | 97½ | 104 | 39 | 58 | 67 |
| Total | 223 | 290½ | 306½ | 392 | 138½ | 197 | 298 |
| Overall total | 493½ | 575 | 607½ | 680½ | 272½ | 528 | 481 |
| Average time per week | 41 | 44 | 50½ | 52 | 54½ | 58½ | 48 |

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1. Of this total 44.0% was reported as relating to secondary stage and 49.7% to primary
2. Of this total 78.0% was reported as relating to secondary stage and 9.1 to primary.

**Table 13.5** **Percentage distribution of time by four Science Advisers**

| | Adviser P | | Adviser Q | | Adviser R | | Adviser S |
|---|---|---|---|---|---|---|---|
| | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| Total time analysed (hours) | 49½ | 575 | 607½ | 680½ | 272½ | 528 | 481 |
| **Activity** | % | % | % | % | % | % | % |
| Travelling | 18.6 | 17.3 | 10.7 | 10.2 | 11.0 | 14.1 | 9.4 |
| Correspondence | 7.3 | 7.8 | 16.0 | 15.3 | 14.3 | 11.0 | 14.0 |
| Planning alone | 17.9 | 16.0 | 6.6 | 8.1 | 19.4 | 32.3 | 12.1 |
| Personal contacts | 50.7 | 55.1 | 51.6 | 61.4 | 62.4 | 53.2 | 50.3 |
| In schools | 17.8 | 17.4 | 22.7 | 13.6 | 22.9 | 26.6 | 14.4 |
| In-service courses for teachers | 4.4 | 7.1 | 5.0 | 6.8 | 19.8<br>8.5 | 2.6 | 14.4 |
| Lectures and meetings in science | 5.2 | 11.7 | 5.4 | 10.4 | 2.9 | 0.6 | 9.2 |
| With administrators | 7.6 | 8.3 | 5.7 | 4.3 | 0.0 | 6.2 | 3.3 |
| With other advisers | 7.4 | 4.8 | 5.8 | 8.3 | 3.5 | 5.5 | 5.7 |
| Planning in connection with labs | 21.5 | 17.4 | 3.6 | 2.8 | 4.0 | 4.8 | 8.0 |
| Planning and advising on curriculum | 10.9 | 8.9 | 16.9 | 10.4 | 7.1 | 13.7 | 17.5 |
| Reading in science education | 3.5 | 3.6 | 3.2 | 3.9 | 0.0 | 0.8 | 7.9 |

For the other three Advisers, lectures and meetings on science topics accounted for more time than did reading, but together they provided from 8% to 17% of total time and were likely to be the formal means of keeping abreast of thinking in science and in science education.

Only for Adviser P were the requirements of laboratory design and organization time-consuming and he spent about one fifth of his time planning and advising on this, while planning for and advising on the curriculum, in the same period, took only half the time he spent on laboratories. This was possibly a non-recurrent activity, but when it did occur reduced the time available for other activities. It was, indeed, the largest single item for this Adviser, exceeding even the total time spent in schools.

The Advisers with general advisory duties appeared to spend a higher percentage of time in the schools and within them to spend more time talking with the head teachers, as Table 13.6 shows. This is consistent with their general responsibility for the schools in their area.

Table 13.6. Percentage distribution of time in schools by four Science Advisers

| | Adviser P | | Adviser Q | | Adviser R | | Adviser S |
|---|---|---|---|---|---|---|---|
| | Autumn | Spring | Autumn | Spring | Autumn | Spring | Autumn |
| Total time analysed (hours) | 88 | 100 | 138 | 92 | 62 | 140 | 69 |
| | % | % | % | % | % | % | % |
| Head teachers | 25.0 | 10.0 | 55.2 | 55.9 | 36.8 | 54.2 | 22.3 |
| Head of department | 60.2 | 88.0 | 15.8 | 14.5 | 25.6 | 7.4 | 27.3 |
| Probationers | 0.0 | 0.0 | 5.0 | 9.3 | 10.4 | 7.8 | 0.0 |
| Other teachers | 14.8 | 2.0 | 24.0 | 20.3 | 27.2 | 30.6 | 50.4 |

Advisers Q, R and S spent more time with "other" teachers than with heads of departments. This is not so with Adviser P who spent much of his time in the schools with the heads of departments. Within this LEA the Advisers enter the schools only on invitation and it is possible that this may limit the Adviser's contacts with other teachers, as few assistant teachers would take the initiative in inviting the Adviser into the school. As this Adviser has not responsibility for the probationary teacher, this does not occasion further visits. It is possible that the sharing of general advisory duties may carry with it the supervision of probationary teachers, though whether these would be restricted to a subject specialism is not clear.

No special category was provided for entry of time spent in the appointment of teachers, as it was anticipated (wrongly, as it happened) that this activity would not feature to any appreciable extent in the Autumn or Spring terms. The notes of Advisers Q and S indicate that considerable time was given to this, for Q in the Autumn term and for R in the Spring term, partially accounting for the high entry in the "other" category in 13.4 (i) for these terms.

The time spent by the Advisers with administrators and other advisers varied from 9% to 15%. This was generally more time than they spent with all science teachers in schools (after deducting time spent with the head teacher).

Some further contact with teachers may be made through meetings and in-service courses, but the time used in running in-service courses for teachers was relatively small in both terms - less than 10% for all but Adviser S. (The notes on the summary sheets showed that considerable blocks of planning time went into the preparation of these courses.) Moreover, the teachers attending such courses are usually not the ones most in need of such contacts.

The teachers of the 17 LEA survey reported six of the Science Adviser role statements[1] as very important (5-10). From the opinions reported in the LEA questionnaire (12 LEAs) statements 5 - 9 appeared especially important. Four of these (5, 6, 8 and 10) require close contact and frequent discussion with teachers. The results of the Science Advisers' Job Study suggest that by spreading the activities of the Adviser widely, the roles perceived as most important may not be achieved.

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[1] See p. 13.02

## CHAPTER 14

### 1. THE VALIDITY OF THE PROPOSED COMMUNICATION-SUPPORT SYSTEM

Discussion of the items comprising the communication-support system had revealed two causes for concern:

(i) all elements were given equal weighting, either positive or negative;

(ii) we were concerned in some elements both with their presence and their quality - e.g. in factor 4 (a), (b) and (c) (p.11.02).

A similar problem faced those involved in the DES enquiry into the efficiency of local education authorities in 1967.[1] For this District and Divisional Inspectors were asked to grade each LEA on a five point scale for provision of education services, from "very good" to weak", with grade 3 as "acceptable". They were required further to grade the Authority over an identical scale under 16 specific headings. "The relative importance of each of these headings was assessed by the combined judgement of Divisional Inspectors and expressed as a percentage weight." Some headings are shown below in weighting order. Items 1 and 2 include headings referring both to the adequacy of the number or range of personnel and to their quality.

| Percentage weight | | Heading No. |
|---|---|---|
| 9 | Quality of senior administrative staff | 1 (b) |
| 8 | Quality of specialist advisory staff | 2 (b) |
| 8 | Arrangements for in-service training | 5 |
| 8 | Expenditure on books and equipment | 10 |
| 7 | Adequacy of number of senior administrators | 1 (a) |
| 7 | Willingness to experiment | 4 |
| 7 | Staffing policies | 6 |
| 7 | Efficiency with respect to educational building | 9 |
| 6 | Adequacy of range of specialist advisory staff | 2 (a) |
| 6 | Encouragement of modern educational methods | 3 |

It was decided to attempt a similar weighting for elements of the communication-support system. These were arranged in a more generalized form and statements about the adequacy of the range and quality of science teachers in the schools were added. Although not strictly part of the communication-support system, the appointment of teachers was the responsibility of the LEA and, in discussion, we were so frequently told we had omitted the most important factor - the teachers - that it was included to obtain a rating relative to the other factors.

The revised list (See Table 14.1) was sent to several science advisers with a request to give each of the twenty-five elements a percentage weighting. Three advisers weighted the complete list, (though not all as a percentage weighting), but the elements in all three fell into three natural groupings - the middle group for two of them having upper and lower sub-groups. These groups were allocated grades[2] which are displayed in Table 14.1, together with the total scoring.

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[1] Royal Commission on Local Government in England, 1966-1969. Vol. III Research Appendices, HMSO 1969.

[2] (3) = high; (2+, 2, 2-) = middle; (1) = low weighting

Table 14.1. Communication and support for change in science education in an LEA (Revised form)

| | Advisers | | | Total |
|---|---|---|---|---|
| | X | Y | Z | |
| 1. Advisory services | | | | |
| (a) Adequacy of allocation of advisory personnel for science education | 3 | 2- | 3 | 8- |
| (b) Adequacy of quality of advisory personnel for science education | 3 | 3 | 3 | 9 |
| 2. Staffing | | | | |
| (a) Adequacy of the range of science teachers employed | 3 | 2- | 3 | 8- |
| (b) Adequacy of the quality of science teachers employed | 3 | 3 | 3 | 9 |
| 3. Financing and Building | | | | |
| (a) Flexibility of financial arrangements | 3 | 2- | 2- | 7= |
| (b) Adequacy of grants for special developments in science | 2 | 3 | 2+ | 7+ |
| (c) Adequacy of provision of accommodation for science | 1 | 2- | 2- | 5= |
| 4. Initiative within LEA | | | | |
| (a) Provision of trial schools for science projects | 3 | 3 | 3 | 9 |
| (b) Encouragement of local developments in science education | 3 | 2+ | 3 | 8+ |
| (c) Use of CSE Mode 3 by science departments | 1 | 2- | 2- | 5= |
| (d) Quality of response to special problems | 2 | 1 | 2- | 5- |
| 5. Communications | | | | |
| (a) Adequacy of LEA communications with schools | 2 | 2+ | 2- | 6± |
| (b) Adequacy of inter-school communications | 2 | 2+ | 2- | 6± |
| 6. Arrangements for in-service education | | | | |
| (a) Adequacy of teachers' centre provision in science | 2 | 1 | 1 | 4 |
| (b) Promotion of courses in science | 2 | 2+ | 2+ | 6++ |
| (c) Support for teachers on courses | 1 | 2+ | 2+ | 5++ |
| (d) Use of local teachers in courses | 1 | 2+ | 2+ | 5++ |
| 7. "External" influences | | | | |
| (a) support for science education available from other institutions | 2 | 2+ | 2+ | 6++ |
| (b) Industrial links with schools | 1 | 1 | 2- | 4- |
| (c) Activity of local ASE | 1 | 1 | 2+ | 4+ |
| (d) Support for science education from other individuals | 1 | 2- | 1 | 4- |
| (e) "Insularity" of area | 1 | 1 | 1 | 3 |
| (f) Staff turnover (stability of staffing) | 2 | 2- | 1 | 5- |
| (g) Ease of travel to centres serving science education | 1 | 2- | 2- | 5= |
| (h) Incidence of special problems affecting secondary schools | 2 | 1 | 1 | 4 |

The overall groupings emerging from this are as follows:

**Table 14.2.** Scores for communication-support items derived from three science advisers' weighting.

| | | |
|---|---|---|
| Adequacy of quality of advisory personnel | 9 | high |
| Adequacy of the quality of science teachers | 9 | |
| Provision of trial schools | 9 | |
| Encouragement of local developments | 8+ | |
| Adequacy of allocation of advisory personnel | 8- | |
| Adequacy of range of science teachers | 8- | |
| Adequacy of grants for special developments | 7+ | |
| Flexibility of financial arrangements | 7- | |
| Promotion of courses in science | 6++ | medium |
| Support available from other institutions | 6++ | |
| Adequacy of LEA communication | 6+- | |
| Adequacy of inter-school communications | 6+- | |
| Support for teachers on courses | 5++ | |
| Use of local teachers in courses | 5++ | |
| Stability of staffing | 5- | |
| Quality of response to special problems | 5- | |
| Adequacy of provision of accommodation | 5= | |
| Use of Mode 3 CSE | 5= | |
| Ease of travel | 5= | |
| Activity of local ASE | 4+ | low |
| Adequacy of teachers' centre provision in science | 4 | |
| Incidence of special problems | 4 | |
| Industrial links with schools | 4- | |
| Support from other individuals | 4- | |
| "Insularity" of area | 3 | |

It is well to note that none of the three areas served by these advisers suffered from "insularity", nor from a high teacher turnover. One further adviser, for whom this was a problem, indicated that 40% of total scoring should go on this item, with 25% on release of teachers for in-service education.

An attempt was made to discover teachers' assessment of some of these factors by including them in the questionnaire survey. Teachers were asked to report whether twenty-five factors operated in a facilitating or limiting fashion[1] on their use or rejection of specified projects. Analysis of frequency counts (Table 14.3) shows that both users and rejecters of projects responded in similar ways to ten of these factors that were related to the communication-support system:

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[1] 5 = strongly facilitating; 4 = facilitating; 3 = no influence; 2 = limiting; 1 = strongly limiting.

**Table 14.3.** **Facilitating and limiting factors relating to the use of projects (a) referring to a familiar or used project, (b) referring to a rejected or least familiar project.**

| | | % saying "no effect" | | Mean | |
|---|---|---|---|---|---|
| | | (a) | (b) | (a) | (b) |
| (i) | availability of special grants to start project | 11.6 | 35.7 | 3.0 | 2.6 |
| (ii) | availability of money to keep project going | 16.5 | 37.0 | 2.7 | 2.2 |
| (iii) | accommodation available | 21.4 | 33.7 | 2.5 | 2.2 |
| (iv) | support by LEA for attending courses | 32.9 | 48.9 | 3.6 | 3.2 |
| (v) | contacts with trial schools involved in project | 54.4 | 53.5 | 3.2 | 2.8 |
| (vi) | rate of turnover of teaching staff | 58.2 | 62.3 | 2.7 | 2.6 |
| (vii) | activities of the LEA advisory service | 61.0 | 68.7 | 3.3 | 3.1 |
| (viii) | activity of LEA teachers' centres | 61.7 | 72.5 | 3.3 | 3.0 |
| (ix) | availability of Mode 3 CSE | 66.4 | 71.8 | 3.3 | 3.0 |
| (x) | activity of other institutions | 68.8 | 80.4 | 3.2 | 3.0 |

The first four factors (finance and accommodation available and support for in-service courses) appear to be more important than the others in the sense that fewer teachers reported them as having "no effect" on their use of projects.

The mean scores for items (ii) and (iii) show that both users and rejecters of projects saw them as making demands on accommodation and department running cost that were not readily being met. Support for in-service courses was seen as overall facilitating, although more teachers reported it as having "no effect". The mean of 3.0 for users reporting the availability of initial grants, taken with the small percentage actually reporting category 3, indicates that while some teachers had received generous grants, others may have introduced the use of some project without what they saw as adequate financial help. On the other hand, because the group of "adopters" included those who may have been "most familiar" only with a project, the responses on the limiting side for this group may reflect a restricted use because of limited grants.[1]

For the remaining six factors in Table 14.3 more than 50% of teachers reported each as having "no effect", so that we may assume that they appeared to have less influence to a teacher on his use of projects. However, the rate of turnover of teaching staff was seen as having an overall limiting effect and the contact with trial schools was the only factor that showed an overall mean for adopters as facilitating and rejecters as limiting. While the last four items were generally less important to most, they were facilitating for adopters and one is well aware that, apart from the availability of Mode 3 CSE, they may not be available in all areas.

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[1] This argument could apply, of course, to all means for this group.

A more detailed analysis was carried out of the responses of adopters and rejecters of three Nuffield projects[1]: O-level Biology, Combined Science, and Secondary Science. The factors relevant to the communication-support system are shown in Table 14.04, together with the means that discriminated for adopters and rejecters.

Table 14.4. Communication-support factors discriminating between adopters and rejecters of specified projects

(a) mean response when project is most familiar or useful

(b) mean response when project is least useful or rejected.

| Variable Number | | O-level Biology | | Combined Science | | Secondary Science | |
|---|---|---|---|---|---|---|---|
| | | (a) | (b) | (a) | (b) | (a) | (b) |
| | N = | 78 | 17 | 89 | 24 | 22 | 25 |
| 055-6 | rate of turnover of teaching staff | 2.8 | 2.7 | 2.5 | 2.4 | 2.5 | 2.5 |
| 059-60 | availability of special grants to start project | ← 2.8 | 2.1 | 2.9 | 3.2 | ⇐ 3.0 | 2.0 |
| 061-2 | availability of money to keep project going | ← 2.6 | 1.8 | ← 2.6 | 3.1 | 2.4 | 2.0 |
| 063-4 | accommodation available | 2.5 | 2.1 | 2.4 | 2.4 | ← 2.4 | 1.9 |
| 073-4 | availability of Mode 3 CSE | 3.1 | 2.8 | ← 3.3 | 3.1 | ⇐ 3.8 | 3.0 |
| 077-8 | availability of technicians | ← 2.3 | 1.8 | 2.7 | 2.4 | ⇐ 3.2 | 1.8 |
| 083-4 | activity of LEA teachers' centre | 3.4 | 3.0 | ← 3.5 | 3.1 | 3.0 | 3.1 |
| 085-6 | activity of other institutions | 3.2 | 3.3 | 3.2 | 3.0 | 3.1 | 3.0 |
| 087-8 | support by LEA for attending courses | 3.5 | 3.2 | ← 3.8 | 3.2 | 3.7 | 3.3 |
| 089-90 | activities of LEA advisory service | 3.2 | 3.2 | ← 3.5 | 3.0 | 3.3 | 3.1 |
| 091-2 | availability of information about curriculum project | 3.4 | 3.3 | 3.7 | 3.5 | 3.8 | 3.4 |
| 093-4 | contacts with trial schools involved in project | 3.1 | 3.0 | 3.2 | 3.0 | ⇐ 3.8 | 2.6 |
| | significance | p - 0.05<br>← | | p - 0.01<br>⇐ | | | |

Only three of the factors did not discriminate for any group: the rate of turnover of teaching staff was seen as universally limiting, information about these projects appeared to be readily available, as this item carried one of the highest facilitating scores, and the activity of other institutions was only marginally facilitating for users.

The availability of an initial grant was highly significant for the adopters of Secondary Science, as were the availability of technicians and Mode 3 CSE, and contact with trial schools. Significant also was the accommodation available, reflecting, perhaps, the finding in the case study investigation that GCE examination groups were given priority where laboratory accommodation was limited. The non-discrimination of grants for continuing the project and the importance of trial schools may be related to the projects' relatively recent publication date at the time of the survey. On the other hand there were more trial schools, more widely distributed, for Secondary Science than for the other two projects.

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[1] These were the three projects for which adequate numbers of adopters and rejecters were available.

Initial grant and continuing financial support were significant for the use of O-level Biology, but, interestingly, the availability of money to keep the project going was seen as more facilitating by the rejecters of Combined Science than by its adopters.

The availability of Mode 3 CSE was important for the use of Combined Science, which is difficult to explain unless it was being used for older pupils than those for whom it was intended. The provision of technicians discriminated for O-level Biology, while the cluster of LEA activities in teachers' centres, advisers and support for in-service courses was significant only for the use of Combined Science, perhaps reflecting the LEAs' greater readiness to accept responsibility for leadership in the science curriculum for younger pupils.

These analyses suggest that to the teachers these factors operated in a variable, selective and complex way on the use of projects, but that all may be important. "Other institutions" are not reported as influential but the case study investigations suggest that they contribute to the level of communication and support for science teachers in the area if their activities are co-ordinated into the accepted pattern of what being a science teacher involves.

Teachers disagree with advisers on the relative importance of the accommodation available in schools (moreover, it appears that "provision of technicians" should be added to the communication-support system), and although advisers' estimate of teachers' centre provision in science reflects reality, it may be potentially more important than they report.

The responses by teachers or advisers to the communication-support factors indicates that it reflects, with acceptable validity, the context in which the schools operate. Further the teachers' responses[1] to other items related to the more immediate environment within the school, and to personal experience and attitudes, supports the theoretical framework of analysis of diffusion and adoption of projects into the three levels of:

Communication-support system (LEA and background)
School
Teacher

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[1] See Curriculum Diffusion Research Project Teacher Questionnaire Report: available from the Library, Centre for Science Education, Chelsea College University of London

There remains the vexed question of the equal weighting of factors. Tentatively one may extract the following as of paramount importance for curriculum development in science in an area:

Table 14.5. Important elements in the communication-support system

| | | Overall grading[1] | |
|---|---|---|---|
| | | 3 Advisers | Teachers[2] |
| (i) | adequate and flexible financial support | H | H |
| (ii) | an aware and efficient advisory service | H | H |
| (iii) | provision of trial schools for national or local projects | H | M |
| (iv) | provision and support for in-service education | M | H |
| (v) | encouragement of local developments | H | |
| (vi) | adequate accommodation and technical help | M | H |
| (vii) | the co-operation of other local educational and industrial institutions | M/L | H/M |
| (viii) | a network of communications institutionalized by formal structures.[3] | M | |

This list covers the most important fifteen of the twenty-five elements of the communication-support system (as reflected by the advisers' rating and teachers' responses), and it may not be possible to discriminate between them, though some may be more measurable than others.

Bearing in mind that the school and the teacher intervene an attempt was made to assess the level of operation of the communication-support system in each of the twelve LEAs for whom information was available and to relate this to the use of curriculum development projects in these areas.

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1. H = high; M = medium; L = low.
2. Teacher Questionnaire Responses.
3. See Chapter 15.

## 2. THE TESTING OF HYPOTHESES

### The relevance of LEA data to the communication-support system.

Table 14.5 summarizes what appear to be the most important elements in the local communication-support systems. It has not been possible to ascribe relative weightings to these elements.

When the responses of the LEAs to the questionnaire sent to them were examined it was decided that items 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 14/15, 17, 18 and 19 were suitable for scoring. These were categorized into the elements of the summarized form of the communication-support system as shown in Table 14.6 below.

Table 14.6. The distribution of scored items of the LEA questionnaire among elements of the communication-support system

| Element in Communication-support system[1] | Item in LEA questionnaire[2] |
|---|---|
| (i) | 10, 11, 14/15 |
| (ii) | 7 |
| (iii) | 9 |
| (iv) | 1, 17, 18, 19 |
| (v) | |
| (vi) | 12 |
| (vii) | 2, 6, 8 |
| (viii) | 3, 4 |

If a communication-support score was to be obtained from these responses the LEAs would be graded chiefly in terms of the financial support provided for teachers and projects, their provision and support for in-service training, the local support beyond the LEA and aspects of communication, together with single items referring to advisory support, provision of trial schools and accommodation. All these, however, were important items influencing use of projects in the teacher questionnaire responses, particularly for those using the projects.[3] There was some confidence therefore that information on these items would lead to an acceptable communication-support score, although there remained reservations about relative weightings of items.

### Obtaining a communication-support score.

Data from the LEA questionnaires were summarized on to sheets. Graders were instructed to take size into account in items 7, 8, 11, 12 and 19 and for this purpose were given the size category into which each LEA was placed for the study.[1] The background experience of graders was as follows:

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[1] See Table 14.5.

[2] See Appendix Q. (ii).

[3] See Table 14.3.

Table 14.7. Background experience of graders of LEA information

| Grader | | Background |
|---|---|---|
| X | 1 | School science teaching and College of Education |
| | 2 | School science teaching and adviser in large LEA |
| Y | 3 | School science teaching and Centre for Science Education staff |
| Z | 4 | School science teaching and Research Project |
| | 5 | Visiting tutor from New Zealand College of Education |
| | 6)<br>7) | Young sociologists working as interviewers on industrial training research project |

It is of interest to record that Graders 5, and 6 and 7 felt unable to make the judgements required on many of the items, because of their lack of knowledge of the workings of the educational system in this country.[2] The computed scores obtained by Graders X, Y and Z are shown for each LEA in Table 14.8. Apart from a general tendency for Grader Y to mark high, these show considerable agreement on the first four and last two or three LEAs. An average score was calculated from these separate scores.

## Obtaining a "Familiarity and use of projects" score

Initially it was hoped that the questionnaire enquiry would provide information on the familiarity with, and use of, projects in an area, but as the case-study research developed it was apparent that the variability between schools, even within the same LEA, was so great that even a 25% random sample, of what amounted to a small number of schools, was unlikely to give a reliable score, representative of teachers' familiarity with projects and the use made of them in the area.

Again, the only complete data for all schools, and this only on use of projects, was in the entries for the separate Nuffield O-level science projects. Although these tested the hypothesis only very inadequately, expediency led to their use for this purpose.

## The testing of the hypothesis relating "communication-support" to "use of projects".

Table 14.9 displays the average communication-support scores of LEAs, together with the number of no-response items within the information they provided, against the percentage up-take of Nuffield O-level projects in their schools.[3] Additional information on the

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[1] See p. 7.03 for Table 7.1.

[2] See discussion in Chapter 3 on the importance of experience of the system in the conducting of educational research.

[3] Calculated as described in Chapter 7, p. 7.07.

**Table 14.8.** Score of LEAs on 14 items of communication-support system

| Score | Identification number of LEA | | |
|---|---|---|---|
| | Grader X | Grader Y | Grader Z |
| 53 | | 5 | |
| 52 | | | 5 |
| 51 | | | |
| 50 | 5 | | |
| 49 | | | |
| 48 | | | |
| 47 | | | |
| 46 | | | 12 |
| 45 | | 12 | |
| 44 | | | |
| 43 | 10 | 3 | |
| 42 | 12 | | 10 |
| 41 | | 10 | |
| 40 | | | |
| 39 | | | |
| 38 | | 6 11 | |
| 37 | | 9 | 3 |
| 36 | 3 | | |
| 35 | | 7 | |
| 34 | | 2 | 7 |
| 33 | | | 11 2 6 |
| 32 | | | |
| 31 | | 1 8 | 9 |
| 30 | 1 6 7 9 11 | | |
| 29 | | 4 | |
| 28 | 2 | | 1 |
| 27 | | | 8 |
| 26 | | | |
| 25 | | | 4 |
| 24 | 8 | | |
| 23 | 4 | | |

percentage contribution that "possible" schools made to the total secondary school provision is also included, as this is a measure of the degree of comprehensive reorganization existing in the area.[1]

Table 14.9. LEA communication-support scores related to use of projects.

| LEA identification | Number of no-responses | Average C-S score | 1973 % use Nuffield O | % "possible" schools |
|---|---|---|---|---|
| 5 | 0 | 52 | 50 | 100 |
| 12 | 0 | 44 | 21 | 100 |
| 10 | 1 | 42 | 7 | 100 |
| 3 | 3 | 38 | 2 | 80 |
| 6 | 3 | 34 | 22 | 100 |
| 11 | 1 | 34 | 3 | 60 |
| 7 | 3 | 33 | 0 | 80 |
| 9 | 2 | 33 | 0 | 100 |
| 2 | 3 | 32 | 4 | 95 |
| 1 | 3 | 30 | 15 | 70 |
| 8 | 3 | 27 | 58 | 30 |
| 4 | 4 | 23 | 29 | 50 |

At first sight there appears to be little correlation between communication-support scores and percentage use of projects, but before any hypothesis relating them is dismissed, the following points must be considered:

(i) the LEA questionnaire, even when answered fully, gave only partial information on the elements in the communication-support system as summarized in Table 14.5,

(ii) not all the LEAs answered the questionnaire items fully - it may be significant that those LEAs with lowest scores tended to omit most responses,

(iii) each item of the LEA questionnaire carried equal weighting in the total score,

(iv) the number of items in the questionnaire contributing to each item of the communication-support system was variable, giving unequal weighting to elements in that system as shown in Table 14.6.

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1. These figures refer to 1971, allowing a two year "adjustment" period.

(v) no rational basis for relative weightings of items had been deduced, therefore the weightings obtained fortuitously from questionnaire items was likely to create distortion, particularly as the total scores for half the LEA lay within 5 points,

(vi) the projects contributing to the percentage use score were relevant to a small proportion only of the pupils in some of the schools.

When all of this has been said the conclusion must be that the hypothesis relating the level of communication-support with use of projects has been inadequately tested.

However, some comments on Table 14.9 may be made:

(i) LEAs 1, 8, and 4, with the lowest scores, but relatively high percentage use of projects, had retained grammar schools for longer than the other LEAs. There was, therefore, a closer match between the projects and the school system.

(ii) In LEA 3, a small borough with a low up-take, the leadership within the LEA had been towards primary science and its financial arrangements required planning ahead for three years, neither factor encouraging the introduction of Nuffield O-level courses.

(iii) LEA 10, with a high score, but low up-take, was a large industrial city, with attendant problems.

(iv) LEAs 5, 12 and 6, with relatively high use of projects had been some of the first to reorganize their secondary system, converting the grammar schools into some form of upper school. These had possibly been less disrupted by the reorganization than if they had become "all-through" comprehensives.

It appears, therefore, that the factor most closely relating to the use of the Nuffield O-level projects is the school organization, which is intimately tied up with the aims of the school. The case-studies, which looked more closely at LEAs 1 and 7 (A and B of the case-study LEAs) explored this further, but using qualitative methods.

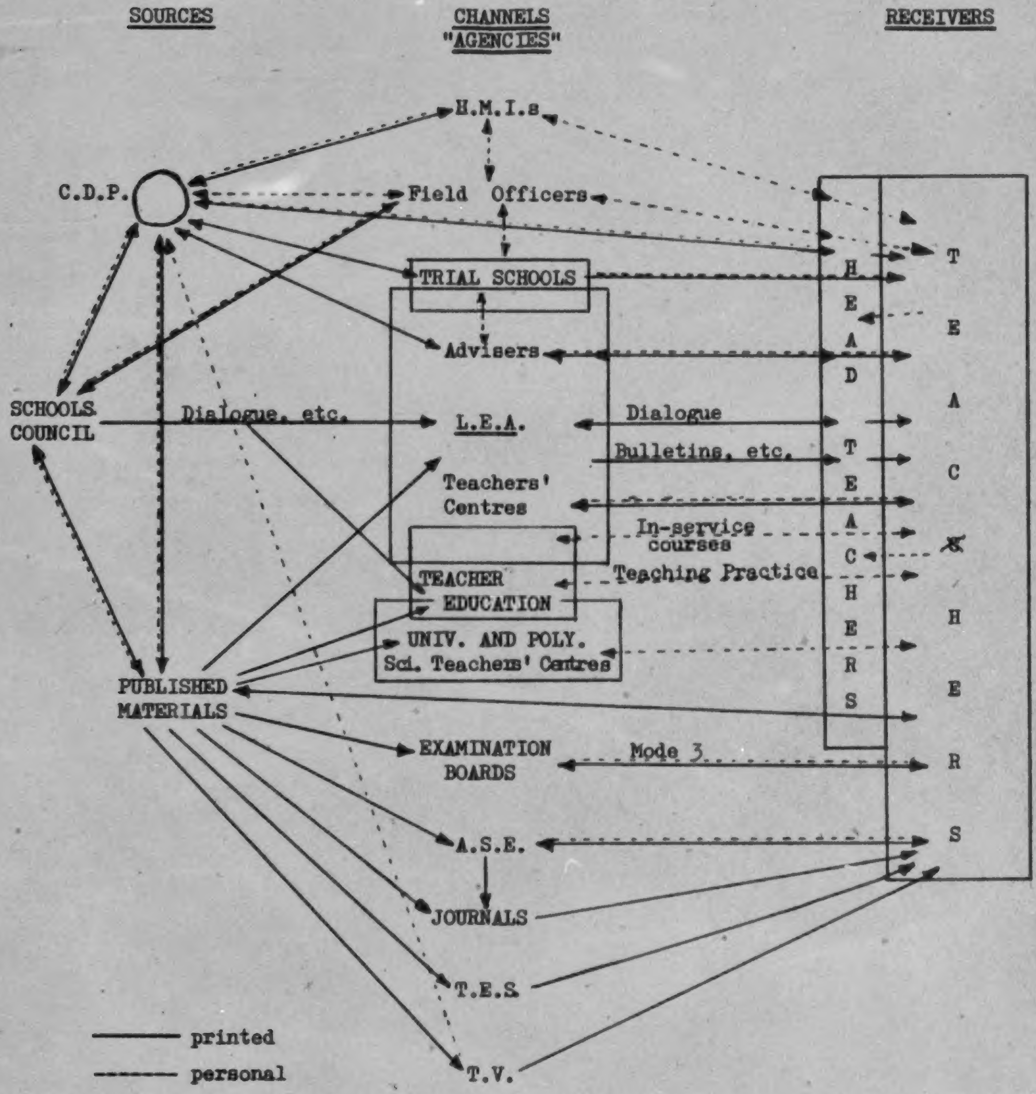
## PART IV COMMUNICATION AND DECISION-MAKING

## CHAPTER 15

## COMMUNICATION STRUCTURES AND PROCESSES

A theoretical analysis of communication channels was used in the construction of the information sources sections of the head teacher and teacher questionnaires.[1] It is possible to represent such an analysis diagramatically:

Fig. 15.1. Communication Structure for a National Curriculum Project


SOURCES
CHANNELS "AGENCIES"
RECEIVERS
H.M.I.s
C.D.P.
Field Officers
TRIAL SCHOOLS
Advisers
SCHOOLS COUNCIL
Dialogue, etc.
L.E.A.
Dialogue
Bulletins, etc.
Teachers' Centres
In-service courses
TEACHER EDUCATION
Teaching Practice
UNIV. AND POLY. Sci. Teachers' Centres
PUBLISHED MATERIALS
EXAMINATION BOARDS
Mode 3
A.S.E.
JOURNALS
T.E.S.
T.V.
HEAD TEACHERS
TEACHERS
printed
personal

---

[1] See Appendices P (i) and P (ii).

Such a representation displays the components of a communications system, but can do little to convey the complexities of interaction between the agencies that may intervene between the curriculum development project and the receiving school system. Attempts to enquire into these were made using the questionnaire and case studies within four LEAs.

## Questionnaire Data

### Reception of information by head teachers

The head teachers' questionnaire responses suggested their heavy reliance for information on their own heads of department or official publications such as circulars from projects or the Schools Council's "Dialogue".

Table 15.1. Head teachers: 8% National sample

| Information sources | Rated 5-1 | | Ranked 1-4 | |
|---|---|---|---|---|
| | mean | order | weighted mean | order |
| heads of department | 3.6 | 1 | 4.0 | 1 |
| curriculum project circulars | 3.4 | 2 | 3.0 | 2 |
| "Dialogue" | 3.3 | 3 | 2.7 | 3 |
| assistant teachers | 3.2 | 4 | | |
| LEA advisers/inspectors | 3.1 | 5= | 2.4 | 4 |
| LEA circulars | 3.1 | | | |
| DES memoranda | 3.1 | | | |
| other Schools Council publications | 3.1 | | | |
| T.E.S. | 3.0 | 9= | | |
| other head teachers | 3.0 | | | |

Table 15.2 Head teachers: 25% sample in 17 LEAs

| Information sources | Rated 5-1 | | Ranked 1-4 | |
|---|---|---|---|---|
| | mean | order | weighted mean | order |
| heads of department | 3.5 | 1 | 3.5 | 1 |
| curriculum project circulars | 3.4 | 2 | 3.2 | 2 |
| "Dialogue" | 3.2 | 3 | 2.4 | 4 |
| assistant teachers | 3.1 | 4= | | |
| LEA advisers/inspectors | 3.1 | | 2.3 | 5 |
| LEA circulars | 3.1 | | 2.5 | 3 |
| DES memoranda | 3.1 | | | |
| other Schools Council publications | 3.0 | 8= | | |
| other head teachers | 3.0 | | | |

The position of the LEA circular is interesting, assuming as it did equal fifth rating with LEA adviser for the national sample and even third ranking for the 17 LEA sample of head teachers, indicating again[1] that LEAs could place more confidence than many of them apparently do in the effectiveness of their bulletins or circulars.

The direction of communication from teacher to head teacher, and the importance that the LEA adviser/inspector assumed for the head teacher, creates an interesting dilemma for the adviser. What proportion of his time should be spent in schools and, when there, should he spend more time with heads or with teachers?

The Science Adviser study[2] revealed that the proportion of an adviser's time in schools could vary from 14% to 26% of his total time on the job, taken termly. The time he spent with the head teacher appeared dependent on whether his appointment carried a general advisory capacity in addition to the subject specialism, assuming a greater proportion if it did. However, it would not be permissible to deduce that this increased time with heads would necessarily result in a greater flow of information to the head teacher about curriculum projects in general, or even only in science, since consultations between general advisers and head teachers are likely to focus on general administrative matters, often to do with staffing.

The relative contact times with heads of departments and other teachers varied between advisers and possibly depended on how their roles were interpreted by themselves or by others in their local situations.

The reception of information by science teachers

The teachers had a greater number of alternative sources of information when the field narrowed from head teachers and all projects to science teachers and science projects. The overall responses for teachers in the 17 LEA sample differed little from those in the 12 LEA sample discussed earlier[3]. ASE publications and science teachers in the same school were of overwhelming importance and five other science sources appeared before LEA circulars, ranked thirteenth in usefulness. The LEA adviser/inspector ranked eighth in both samples, but meetings organized by the LEA ranked only twelfth in the larger sample, suggesting perhaps that proportionally more LEA meetings were organized in the 12 LEA sample, as both samples reported the same marginally greater frequency of attendance at LEA meetings than at those organized by other bodies.

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[1] See Chapter 12.

[2] See Chapter 13.

[3] See Chapter 12.

The Times Educational Supplement, apparently read as frequently as LEA Bulletins, was more informative about curriculum projects (ranking third). Science teachers from other schools were reported to be next most useful, thus emphasizing the importance of formal structures in bringing teachers together.

The importance that information originating from the Curriculum Development Projects themselves has assumed is highlighted in the ranking of this source as second most useful for head teachers and sixth for teachers. The pattern of sales of published materials shows the highest annual figures coming in the first full year after publication[1] (except for later years of pupil-texts in a sequential course). This suggests that dissemination strategies (circulars, trial schools, in-service training boosts) have tended to create an initial maximum period of interest and not the slow build up to an S-shaped curve of many adoption studies. One may speculate that, within the existing organizational structures in England and Wales, if a project does not arouse this initial interest then its impact on the school system will be negligible. This poses an increasing problem for dissemination as projects become more commonplace.

## Case Study Data

One of the roles for the case study programme was to enquire further into the complex interaction of communications in a local area.

Our common experience of science teaching in schools had led us to expect that groups of teachers would come together regularly in connection with examining, the ASE, teaching practice and perhaps other activities organized by local institutions. The communications interview schedule[2] was structured to enquire into the existence and influence of such groups in the areas visited.

Figures 15.2, 15.3, 15.4 and 15.5 display some of the formal structures and personal communication channels arising from them in LEAs (A), (B), (C) and (D) respectively.

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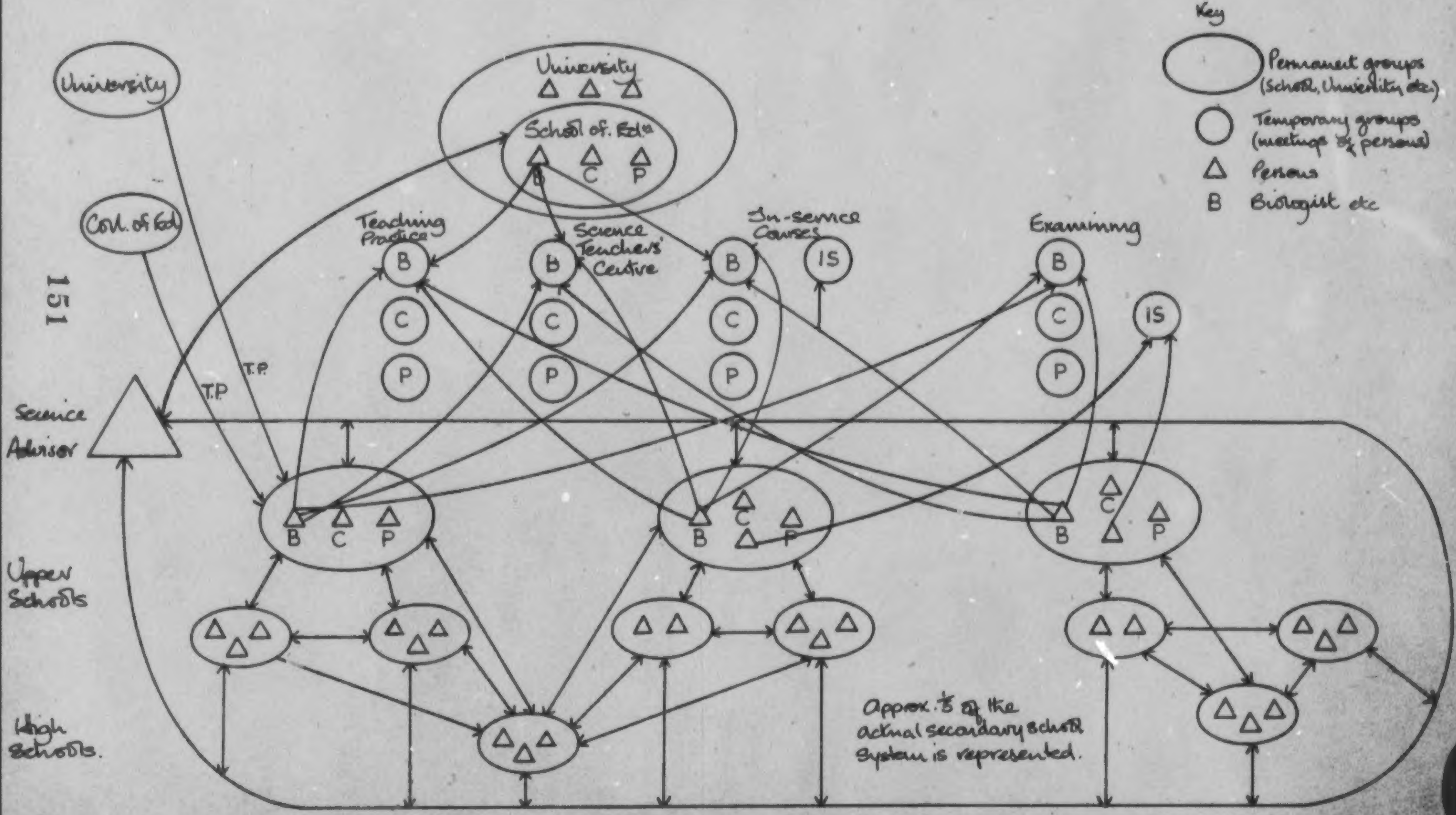
1. See Chapter 4.
2. See Appendix R(iv) and S(i)F (for discussion of the use of a schedule)

Fig. 15.2 LEA (A) Communication channels arising from formal structures


Key
Permanent groups (School, University etc)
Temporary groups (meetings of persons)
△ Persons
B Biologist etc
University
University
School of. Edn
B
C
P
Coll. of Ed
T.P
T.P
Teaching Practice
Science Teachers' Centre
In-service Courses
Examining
B
C
P
IS
IS
Science Adviser
Upper Schools
High Schools.

Approx. ⅓ of the actual secondary school system is represented.

Fig. 15.3 LEA (B) Communication channels arising from formal structures

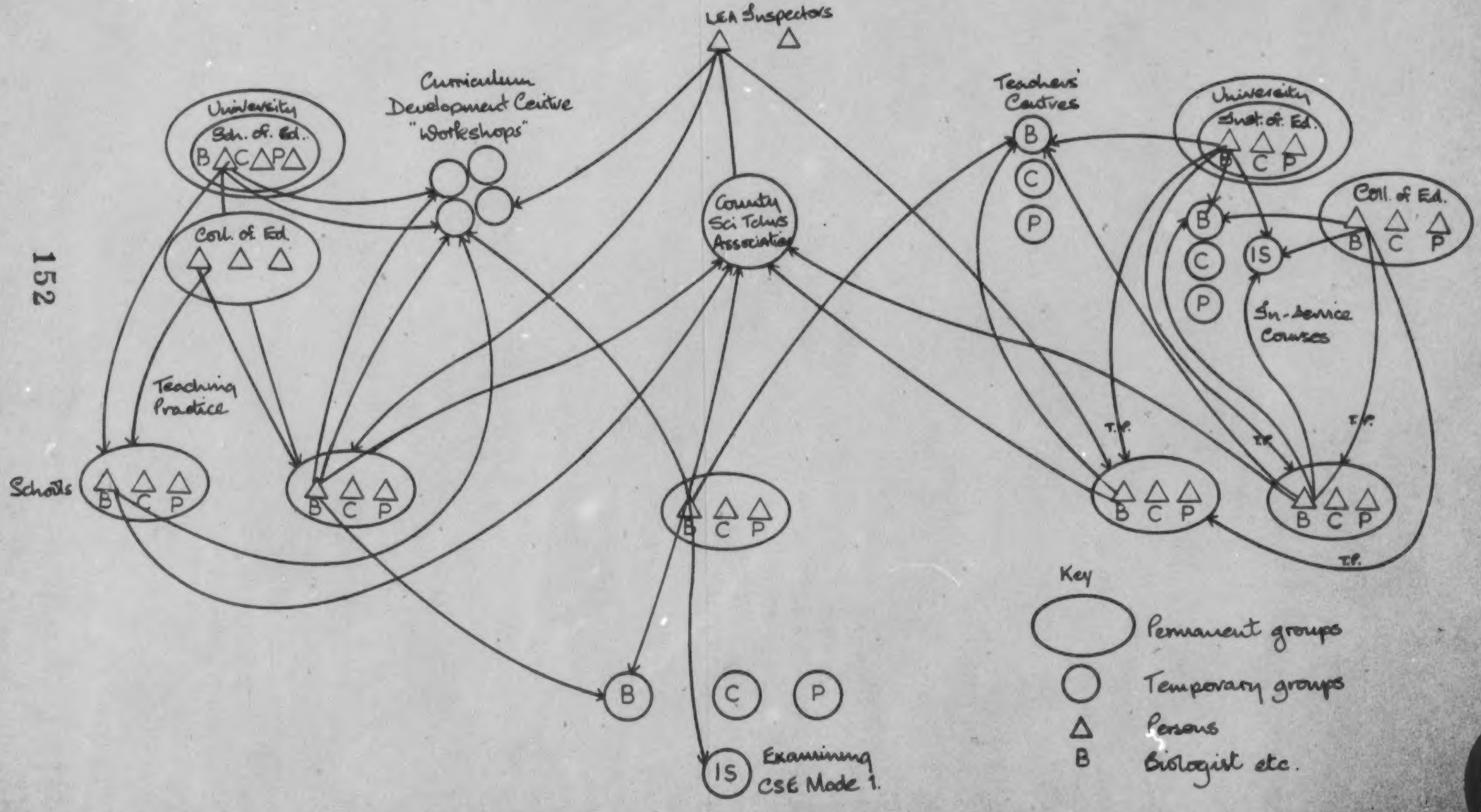

LEA Inspectors
Curriculum Development Centre "Workshops"
University Sch. of Ed.
B C P
Coll. of Ed.
Teaching Practice
Schools
B C P
County Sci Tchrs Association
Teachers' Centres
B C P
University Inst. of Ed.
Coll. of Ed.
IS
In-service Courses
T.P.
IS Examining CSE Mode 1.
Key
Permanent groups
Temporary groups
Persons
B Biologist etc.

Fig. 15.4 LEA (C) Communication channels arising from formal structures

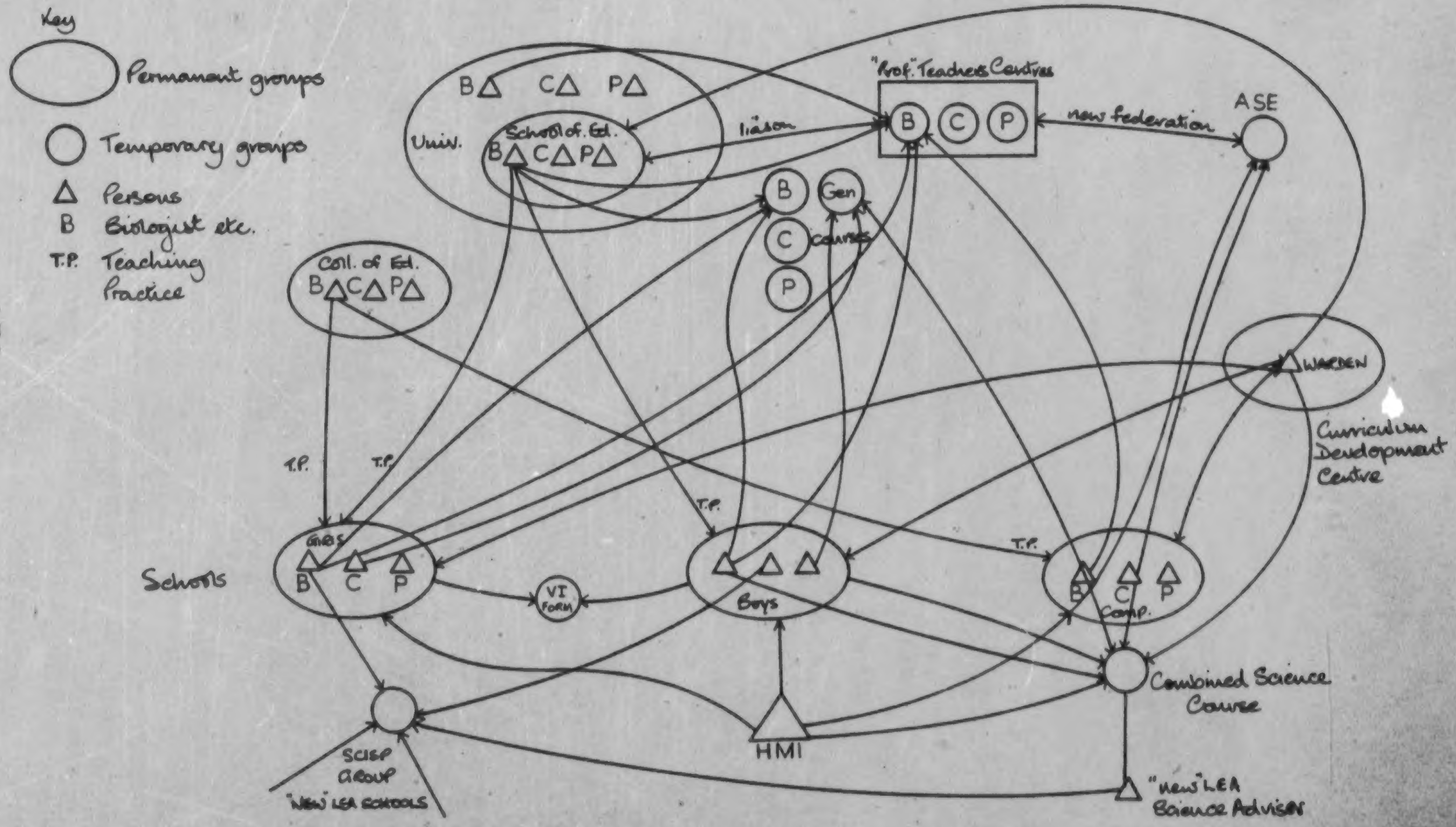
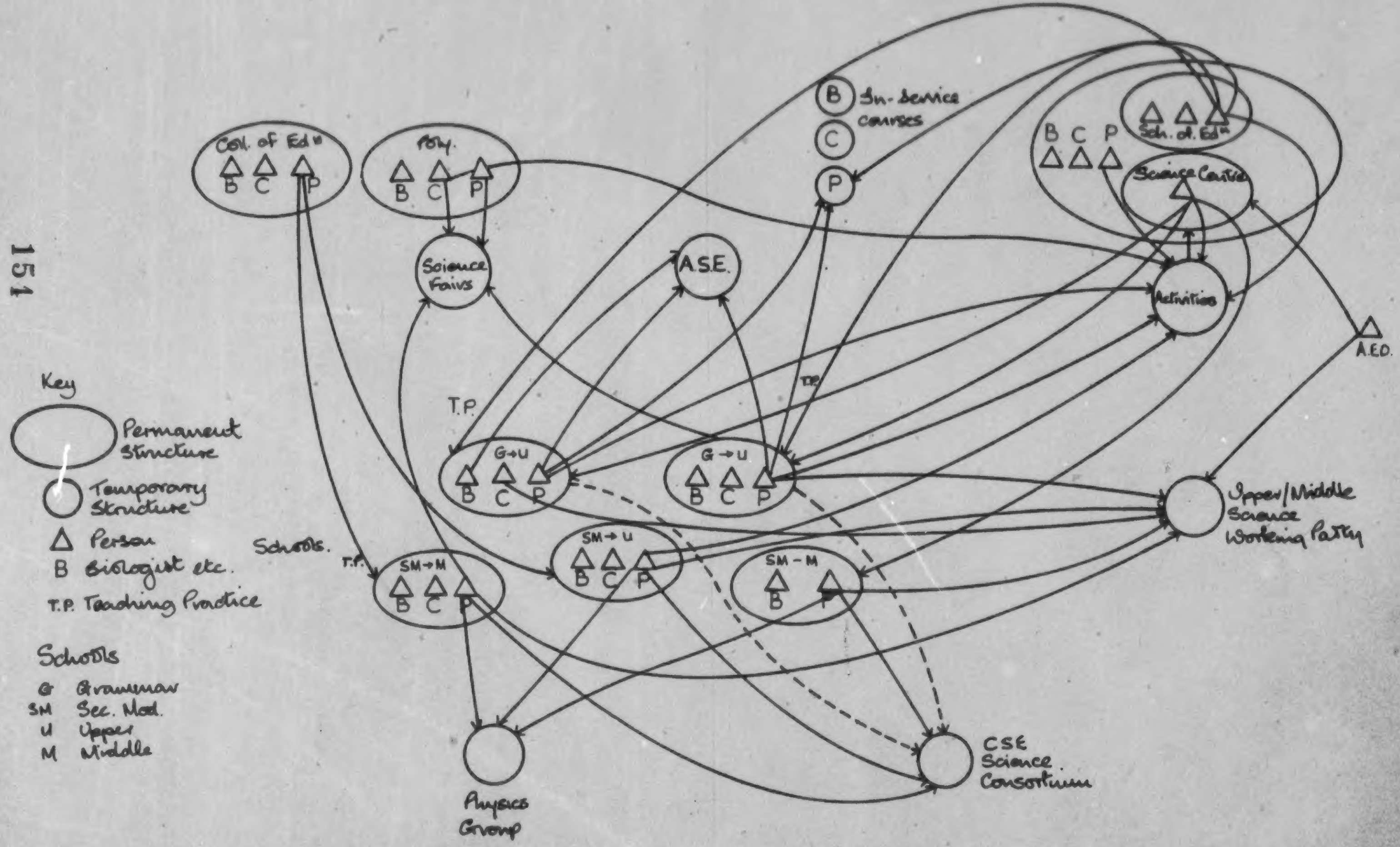

Key
Permanent groups
Temporary groups
△ Persons
B Biologist etc.
T.P. Teaching Practice
Univ.
B△ C△ P△
School of. Ed.
B△C△P△
liason
"Prof." Teachers Centres
B C P
new federation
ASE
B Gen
C courses
P
Coll. of Ed.
B△C△P△
WARDEN
Curriculum Development Centre
T.P.
T.P.
T.P.
T.P.
Schools
GIRLS
B C P
VI FORM
Boys
Comp.
B C P
Combined Science Course
HMI
SCISP GROUP
"NEW" LEA SCHOOLS
"New" LEA Science Adviser

Fig. 15.5 LEA (D) Communication channels arising from formal structures


Coll. of Edn
B C P
Poly.
B C P
Science Fairs
A.S.E.
B In-service
C courses
P
B C P
Sch. of Edn
Science Centre
Activities
A.E.O.
T.P.
T.P.
T.P.
G→U
B C P
G→U
B C P
Schools.
SM→M
B C P
SM→U
B C P
SM – M
B P
Upper/Middle Science Working Party
Physics Group
CSE Science Consortium
Key
Permanent Structure
Temporary Structure
Person
B Biologist etc.
T.P. Teaching Practice
Schools
G Grammar
SM Sec. Mod.
U Upper
M Middle

Teacher Education Institutions

Within each of the LEA areas (or on its borders) there were both a University School, Department or Institute of Education and at least one College of Education. Where the contacts of teachers with these were solely through the visits of tutors to schools to supervise students on teaching practice they were of limited value as communication channels. But in two of the areas the School of Education assumed a wider function. Figure 15.2 shows the importance in LEA (A) of the University School of Education personnel in maintaining structures that brought groups of teachers together, for teaching practice was organized through their co-tutor system, they were closely involved in the running of the "professional" teachers' centres (see later) and organized in-service courses. In addition, together with the local science advisers, they were responsible for annual "think-ins" for separate groups of upper school biology, chemistry and physics teachers (not shown).

It is important to note that these structures involved teachers from upper schools, but not high schools, and that all four activities were usually organized within subject specialisms, thereby maintaining the identity of the specialist science teacher in each of the three recognized sciences, and his separation from the other two sciences.[1]

In LEA (C) (Fig. 15.4) the School of Education had provided in-service courses in science, directed towards the Nuffield projects from 1966, but few of the teachers interviewed had attended them until relatively recently. An active tutor in biology, with a concern for schools, had developed a Science News Letter covering curriculum projects, courses, new publications and other useful information. She was frequently mentioned as a source of advice in the schools. Support for chemistry was developing through a relative newcomer at the School of Education, but in physics this was less apparent and there appeared to be a parallel inertia in physics in many of the schools visited.

Again, the separation of the sciences was apparent; teachers and tutors displayed subject identities, separate teachers' centres in biology, chemistry and physics had been established and many courses were organized within science specialisms for examination work. However, one of the aims of the recent Federation[1] formed between the "professional" teachers' centres and the ASE (which were both in contact with the School of Education through its biology tutor) was "to reflect the increasingly interdisciplinary nature of science at both the school and the university level"[2].

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[1] The separate identity of the sciences in schools nationally is shown by the O-level entries: see Chapter 6.

## "Professional" Science Centres

The "professional" science teachers centres are so-called in this study as they generally derived from the three professional bodies: the Institute of Physics, the Royal Institute of Chemistry and the Institute of Biology. The RIC had initiated symposia on various topics, included in the senior years of school chemistry, at various university or polytechnic centres in 1962. The location of these depended on the enthusiasm of personnel in the institutions and in some areas the contacts established between teachers in schools and places of higher education were judged to be of such value that regular meetings were continued. The Institute of Physics began to set up Physics Centres in 1966 and in 1969 the DES offered a temporary grant to any institution to develop centres, sponsored by the relevant professional Institute, including the Institute of Biology, to provide support for school science.

These centres tended to be set up within the separate academic science departments in universities or polytechnics and not in association with Education Departments, though tutors of the latter would often be members of the relevant centre.

In LEA (B)[3] a Chemistry Centre was established first in 1965. The Physics Centre followed in 1970, but its launching document referred to other Physics Centres and not to the Chemistry Centre already in existence on the campus. The Biology Centre came later, 1971, in response to an approach to the head of the Biological Sciences Department by a local teacher.

In LEA (C)[3] the pattern was similar (Chemistry 1969, Physics 1970 and Biology 1971). Here the Biology Centre was administered by the tutor from the School of Education. As already reported, these centres and the local ASE branch had formed a Federation, with the arrangement

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[1] Shown at the top of Fig. 15.4.

[2] Information sent to local teachers in May 1973.

[3] See Appendix S(v) for the recent programme of some of these centres.

PAGE 15.07 WAS MISSING FROM THIS
DOCUMENT PRIOR TO ITS BEING SUBMITTED TO
THE ERIC DOCUMENT REPRODUCTION SERVICE.

In LEA (C) it was reported, however, that the Physics Centre attracted teachers from direct grant and independent schools and "does not yet appear to be of significant service to the ordinary physics teacher in the ordinary school".

While the centres remained autonomous specialist subject centres they reinforced the specialisms in teachers, but there were signs in the developments in areas (C) and (D) that there was an awareness of this and a willingness to act to reduce the constraint it exerted on the development of integrated or interdisciplinary work in schools.

## The Association for Science Education

The importance of the publications of the ASE in communications has already been discussed. In only one of the case study areas was the local ASE branch effective in bringing science teachers together. This was in LEA (D), where a working party had recently produced a "Safety" booklet, while another group was working with the local radio station to explore the possibility of making programmes for schools based on local industrial topics. In the local ASE branch area including LEA (C) there was some evidence that the county science teachers, including those from independent schools, were active, but it involved few of the teachers in LEA (C).

The image of the ASE for some was still orientated to grammar schools and advanced work. Several teachers, particularly in LEA (B), reported non-membership "because no-one had suggested I join", while one new teacher had not even heard of the Association. It is possible that activity within alternative structures for science teachers has reduced the viability of local ASE branches.

## Examining

The membership of examination panels or working parties, particularly for CSE, was an important communication channel for some teachers. Involvement in GCE examining tended to be non-local and while it extended the communication contacts for individual teachers, it had little significance locally, unless the teacher was also a member of other local temporary groups. Within LEAs (A), where Mode 3 CSE examining was the general practice, and (D), where a local CSE "consortium" (see Fig. 15.5) had involved secondary modern teachers and one local science headmaster, the structure provided by the CSE was an important communication channel.

## The influence of the school system

The structures that were significant for teachers and used by them were dependent on the nature of the school in which they taught. This was clearly visible in LEA (D) where the organization of schooling was changing from separate grammar and "modern" secondary schools, each group with its associated communication system, to upper and middle schools, with different needs and resources, giving rise to different communication systems (see Fig. 15.5)

The Physics group here had been an informal group of heads of science in secondary modern schools. These were all men and at least two were emergency-trained teachers in 1946 after war service. They invited speakers to address their meetings, which were generally mutually supportive and were associated with lively departments biassed to physics. This group was no longer in existence; most of the secondary modern schools were becoming middle schools and dropping membership of the CSE Science Consortium also, while the grammar schools, for whom the ASE branch was important, were sending representatives to the Consortium as they developed into upper schools. A very temporary group was the upper/middle school Science Working Party, convened by the AEO with a science background (in the absence of a science adviser). Meetings of this group had been discontinued and the science headmaster reported that satisfactory communication channels had not yet been established between upper and middle schools. As both single sex and mixed upper schools had been created, no formal links existed between specific schools.

It has already been pointed out that the communication structures discussed in LEA (A) did not involve the high schools. The structure of the upper schools imposed separate biology, chemistry and physics meetings on the high schools, even where the course and department in the latter were wholely integrated. Contacts between high schools feeding into a common upper school appeared to be frequent, but where a high school fed into more than one upper school communications were more diffuse.

## Direct inter-school contacts

Only in one area had the LEA institutionalized meetings between science teachers from all their schools. LEA (B)'s response to the "curriculum explosion" had been to set up Curriculum Development Groups in the 1960s, in the main subject areas of the secondary curriculum. In science the group had been convened by a rota of heads of science, for a year each. Activities lapsed over recent years and when the LEA approached a relative newcomer to undertake the convening for 1972-3, he had accepted, if they would agree to run a residential week-end course based on Nuffield Combined Science materials. This they did and the Association grew out of the contacts made. Each school was asked to nominate a member for the organizing committee, and most teachers interviewed considered themselves to be members of the Association. Several had attended meetings and plans were being made to organize "banks" of organisms, teaching aids and equipment.

The relative importance of this Association at the time of interviewing is indicated by its central position in Figure 15.3, but its future was uncertain as the LEA would not exist after 1974 and its schools would be the responsibility of three other newly-formed LEAs.

The fate of the earlier Curriculum Development Group indicates that such an impermanent structure is vulnerable and highly dependent on the vision and organizing ability of each temporary "leader".

In LEA (A), with its variety of structures and where the science adviser collaborated with the School of Education personnel to facilitate "think-ins", comments from teachers showed that they knew each other well, recognized strengths and expertises where they existed, and were prepared to call upon them when the need arose. There was evidence that one large school which had been closely associated with the development and trials of the Nuffield O-level Biology and Physics projects had been a useful communication source for others and it still retained some of its mystique. The most frequently detected attitude to the "new" schools in the area was that of slightly amused tolerance. There was little evidence, at the time of interview, that the individualized learning programme in science being developed in these schools was influencing other local schools. Indeed, there had been little contact between the two schools who were attempting to solve common problems.[1]

In LEA (C) science teachers from maintained schools had been brought together for the first time by the LEA for a 2-day vacation course on Nuffield Combined Science. This had been prompted by the local HMI, had been organized by the Warden of the Curriculum Development Centre, held in a local comprehensive school and staffed by local teachers. Although this was a "one off" group it is included in Fig. 15.4 as several teachers expressed appreciation of the opportunity it gave them to meet with other local teachers. A further development within the "new" LEA, of which (C) was to form a part, was a nucleus of four schools to act as a SCISP dissemination group.

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[1] More contacts have been developed since these interviews were made.

Communications within the schools

Although the teachers' questionnaire responses rated other teachers from their own schools as high sources of information about curriculum projects, the case study investigations showed that the potential level of interaction between teachers was constrained or intensified by several factors.

In all but two of the schools visited there was a head of science appointment, but in most schools there was at least one specialist teacher in each science subject and in the larger schools a head of each separate science department. Laboratories were identified as physics, chemistry or biology. From Year 4 (and sometimes from Year 3, or even Year 1), the sciences were taught separately, except perhaps for the weakest pupils academically.[1] Heads of science would hesitate to "interfere" in the work of a specialism other than their own, recognizing the "professional autonomy" of the separate sciences.

This reflected and sustained the insulation between the sciences and frequently constrained communication between teachers to a superficial level. That this need not be the case is shown by the high level of interaction found between the science teachers in school Be, where the separate sciences were taught from Year 1. Here the leadership of the head of science had created a close-knit department in overcoming the problems arising from very limited accommodation. This group centred on the single prep. room where all met for tea during the afternoon break, thereby creating what amounted to a daily departmental meeting. In school De "we were talking to each other for the first time in years" when the question of what Year 3 course to offer in a reorganized upper school was faced.

The facility offered by the presence of services and a technician for providing tea or coffee in a prep. room was made use of in many schools. While it tended to increase communication between science teachers, it caused a further insulation between science teachers and other members of the staff.[1] This resulted, in some cases, in an orientation and level of morale in the science department different from that in the rest of the school.

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[1] See Appendix S(iv) for the organization of science in schools.

The expansion of facilities for science education over the last decade[2] has resulted in the building of science blocks separate from the main school building and this has further encouraged the association together of science teachers apart from others in the school.[3] But if, as has happened in several cases, extensions have taken only one of the sciences into a new building then communication restraints have developed between the sciences.

The scheduled departmental or faculty meeting in a school arose either from an hierarchical committee structure (developing in the larger schools) or from the innovative climate of the institution which required regular consultation in its problem-solving approach. (This was apparent in schools Aa and Ab, where there existed a self-conscious emphasis on the social aims of education, and in Bb where an interdisciplinary approach to mathematics and science was developing).

These meetings generally took place after school hours and, indeed, senior teachers in some schools were frequently involved in such evening meetings. In one school, department meetings were allowed to start fifteen minutes before the end of the school day so that, hopefully, all teachers would feel constrained to attend. The headmaster of school Ce had timetabled a period (and extended it the following year when it had apparently been successfully used) in which all the science teachers could meet together. The head of science used this for the sharing of expertise in, and the discussion of problems arising from, the teaching of Nuffield Combined Science. (This school also had a Senior Teacher appointment with responsibility for staff in-service education.)

## Communication influence of key people

It is apparent from the discussion already developed that many of the structures shown in Figs. 15.2-15.5 were initiated by persons and depended for their effectiveness on key people.

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[1] In school Ce, however, a large prep room had become the break-time location of a non-smoker group.

[2] See Chapter 12 for a discussion of the provision of new laboratories.

[3] The head of science in school Da refused the architect's offer of a separate staff room in a new science block as she did not wish this to happen.

The influences of the biology tutor in LEA (C) and the Warden of the Science and Technology Centre in LEA (D) have already been discussed.

In only one area, LEA (A), was there a Science Adviser at the time of the case study visits. The communication links of schools with the Adviser are shown (Fig. 15.2) as feeding into a loop enclosing the schools. This symbolises the communication role perceived for the Adviser[1]. In practice contacts occurred through persons: all science teachers had potential access to him, but probably his most frequent contacts were with head teachers and heads of department. From the interviews it appeared that in the upper schools the Adviser was seen as a source of information about equipment rather than curricula as a whole. They seemed unaware of the role he played in bringing materials to their attention. For the high schools he assumed a wider advisory role. However, the time demands on such an appointment, with responsibility spreading to the primary sector also, made personal contacts infrequent.

His tactics in spreading information about curriculum development projects was interesting, for it showed an inventive use of many opportunities, as is illustrated by the case of Nuffield Secondary Science materials. The procedure had been:

1. at the trial stage the LEA had provided three trial schools, but two withdrew after one year,
2. in 1970, with a neighbouring LEA, it had run the first local authority in-service course in the country,
3. in 1971, two half-day courses on Secondary Science were run, but had little response from the schools,
4. the materials were included in the annual residential courses directed towards ROSLA work (little response from science departments),
5. in 1972, all upper schools were offered "mini" ROSLA courses in their own schools in the last weeks of the summer term (only 4 schools took up the offer),
6. in 1973, Secondary Science and SCISP materials were presented at a high school "think-in", organized by the Adviser,
7. the teacher most expert in the use of Secondary Science materials was given a sabbatical year (1973-4). Before he took up his studies in October 1973, the LEA was planning to use him for one week in each of four upper schools "to try to get something going".

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[1] See Chapters 12 and 13.

The mere creation of a Curriculum Development Group, as in LEA (B) (Fig. 15.3), or a Curriculum Development Centre, as in LEA (C) (Fig. 15.4), was no guarantee that science teachers would come together or that communications generally would improve.

In the former case the group ceased to function for a while following the passing of the role of convener to a head of science whose role perception appeared limited to operation within his own school, where he was highly successful in creating a purposeful department. The convener from whose activities the County Science Teachers' Association grew[1] interpreted his sphere of activity more widely and was prepared to spend time and energy in organizing meetings and resources.

In the latter case the Warden at the time of interview was an arts graduate, who also contributed to degree courses in the School of Education. Two years after his appointment the LEA ran its first in-service course in science[2], but this possibly owed more to the presence of a local science HMI, who had taken part in the inspection of science in the LEA and who therefore was aware of the needs of the schools and was known to the local teachers and used as a resource by some of them.

The greater awareness and use of the Nuffield O-level chemistry materials in LEA (D) could possibly be traced to a man who had taught in one of the local grammar schools in the 1960s. He had obviously been an active communicator: he was referred to by name, in his old school and in two others, and had apparently caused an in-service course in Nuffield chemistry to be held, (though exactly where and by whom is not clear, as the LEA denied holding any courses).

The only actively negative influence on the Nuffield projects was detected in LEA (B) where a chemistry tutor in a local Institute of Education was hostile to the O-level chemistry scheme. More than one teacher interviewed had been trained in his department and several quoted his opinions. The overall effect was to sharpen criticism but not, in every case, towards hostility.

## Dissemination processes used by LEAs

The processes used by the LEAs to disseminate materials from Curriculum Development Projects were visible, in part, in the teachers' familiarity with SCISP which was entering its dissemination phase at the time of the interviews.

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[1] See p. 15.10

[2] See p. 15.10

In LEA (A) these took place in the schools, some before and some after a one-day (Saturday) Dissemination Conference, held some sixty miles from the LEA. In one school a high familiarity with SCISP materials was apparent even before the Conference, while from other schools teachers were going to find out more about the project. (This was true even of one school where, organizationally, three entirely separate departments existed: the heads of biology and physics were planning to attend the Conference.) However, in two schools it seemed that junior staff had no knowledge of the Conference.

The communication channel[1] had been:

SCISP team
↓
LEAs (Science Adviser, in this case)
↓
Head teachers (special communication)
↓
Heads of science or
heads of departments
↓
Science teachers

In most cases the information had reached individual science teachers, who had made their own decision about attendance. In two cases the channel had become blocked at some stage, possibly at the head teacher, but also possibly at the head of science, as both men stated they could see no place for such a course. In the one school integrated courses were confined to pupils of lesser ability than O-level, and a separate Combined Science department created to provide them; in the other school the departments were said to be isolated, even though there was an overall head of science. It could be that these contexts had caused the information to go unnoticed.

Information about the same Conference was limited in LEA (B) by the LEA. An inspector telephoned the Secretary of the County Science Teachers' Association and asked him to attend. He did so, but no other teacher had heard about the Conference and at least one young teacher had been disappointed by missing it. However, the LEA inspector possessed some copies of SCISP materials which were on display at local meetings and two heads of science had reported looking at them. In one case this was followed up by the inspector putting the Schools Council Field Officer in touch with the school.

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[1] See LEA (B) for a different procedure resulting in only one teacher attending the Conference.

In LEA (C) the SCISP materials were in the hands of the Warden at the Curriculum Development Centre. The LEA had invited schools, through the head teacher, to become dissemination phase trial schools, offering a grant to cover the expense of this.[1] Two schools had responded and were to be put in touch with two other schools within the "new" LEA area which were similarly hoping to use the course (see Fig. 15.4).

It is possible that a similar invitation was sent to all schools in LEA (D), but no reference was made to this. In school De, where the only active interest in SCISP was found, the science AEO had personally telephoned the head of science to ask if he would be willing to participate in dissemination trials. The reported visibility of SCISP to the latter man is interesting: he first heard of it when the publishers for whom he worked for a time, were invited to tender for publication of the materials. He remembered reference to it being made at a course he attended in 1971, but it did not assume significance for him until the LEA approached him to use the materials for dissemination trials.

## Conclusions

The case study work within 4 LEAs has identified institutionalized structures, in each area, providing a personal communication network highly specific for science teachers[2] (and in some cases specific, but parallel, for biologists, chemists and physicists). The communication structures, while possessing features in common, are to a certain extent specific to each area. In the absence of any single authority structure for the curriculum, the education system is highly responsive to personal initiative working within and extending permitted structures. This conveys an exciting sense of liveliness and growth (of innovation, perhaps), but also a disturbing sense of the vulnerability of a structure in the absence of the key person to energize it.

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[1] This appears to be the first time that the LEA had offered a grant with an invitation to participate in a science project. It had, however, provided grants to introduce Nuffield Combined Science into its school, after the HMI's recommendation of its use, following the inspection of science in the LEA.

[2] It is likely that different local communication structures exist for teachers in other subject areas.

Within each area there was detectable a certain level of expectancy - of what was acceptable to, and expected of, science teachers there[1]. The leadership provided by the LEA is highly influential in determining this level of expectancy[2]. In science this appeared to be high in LEA (A), relatively high in LEA (B), but low in LEA (C). In LEA (D) (the smallest LEA visited) the expectancy was high, but seemed to be less dependent on LEA leadership.

The number of structures present and the level of expectancy appeared to be associated with the proportion of the total number of science teachers participating in the activities (dependency not clear). Where there was high activity there was a relatively high familiarity with curriculum development projects in science.

The status in the eyes of the teacher of the institution with which the structure is associated is important in determining the reception of information within that structure and the constraint that the teacher feels to act in response to it.

The significance for curriculum development projects is the need to marshall the support of institutions involved in communication structures. (There is evidence that the Nuffield Science Teaching Projects did this for the separate science projects - was it so true of the Integrated Science projects?)

The significance for LEAs is the need to identify communication structures, to encourage others that bring teachers together for an acceptable purpose and to ensure that materials to be disseminated are displayed whenever teachers meet together. Within each LEA effective diffusion of curriculum projects depends on there being a person who will assume this responsibility for each area of the curriculum (so that all are covered). This is an advising, enabling role and one that was displayed by the science adviser in LEA (A), the inspector, together with the first secretary of the County Science Teachers' Association in LEA (B), the HMI and Biology Tutor in LEA (C) and the Warden of the Science and Technological Centre in LEA (D). The LEA adviser is uniquely placed to perform this role, but much would be lost if the system closed to reduce the plurality of communications and sources of initiative.

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1. Cane (1966) identified similar regional variations in the differing acceptability to teachers in Glamorgan and Norfolk of in-service courses held during the day.

2. See C.E.R.I. Case studies of educational innovation, Vol.3 (1973) for an account of the level of participation in music in Leicestershire schools and its dependence on the music adviser.

# CHAPTER 16

## PERCEPTION OF PROJECTS

The perception of a curriculum development project found in schools will be dependent both on the effectiveness and selectivity of communication and on the school's orientation towards curriculum development projects in general: whether they are seen as benign and useful, or intrusive and even threatening to the school or the teacher.

The teachers' familiarity with science projects was explored in the questionnaire study. Table 16.1 shows that Combined Science was the most well-known, (but this only at a mean just below the "read a few of the materials" level), followed closely by the three O level projects and Secondary Science. From this one may deduce that, for a large number of teachers, their perception of a project arises from hearsay or, at best, only a superficial contact with it.

Table 16.1 Teachers' reported familiarity with projects

| Project | Mean[1] Familiarity | % reporting category 3 |
|---|---|---|
| Combined Science | 1.9 | 44.2 |
| O level Physics | 1.7 | 35.5 |
| Chemistry | 1.6 | 36.0 |
| Biology | 1.6 | 33.2 |
| Secondary Science | 1.6 | 30.0 |
| Schools Council Integrated Science | 0.8 | 5.2 |
| Scottish Integrated Science | 0.8 | 11.0 |

As Table 16.4 shows, only Combined Science had intended relevance for all pupils in a school containing the appropriate age band. This is likely to affect teachers' familiarity with it relative to other projects. All projects were potentially relevant to comprehensive schools, but Secondary Science was not designed for use in grammar schools and although some secondary modern schools were included in the separate science O level trials, these projects were not primarily developed for their use.

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[1] Recoded means
0 - not familiar
1 - read about or heard of the projects
2 - read a few of the materials
3 - read most of the materials

The ratio of grammar: secondary modern: comprehensive schools in the teacher sample was 14 : 36 : 50, but this does not represent the ratio of the school contexts of the responding teachers, as a variable number of teachers replied from each school.

Analysis of questionnaire responses showed, however, that the teacher's level of familiarity with a particular project correlated with his teaching commitments in subject area, age and ability range of pupils and, in the case of integrated courses, with level of appointment (heads of science being more familiar with these than heads of separate departments or assistant teachers). These factors appeared to over-ride effects of varying time intervals from publication date for the projects (see Table 16.4)

Effects of projects

The elements of cynicism towards curriculum development projects revealed in the interviews with the LEAs[1] caused us to include a section in the questionnaires[2] to investigate head teachers' and teachers' views of the effects of curriculum projects.

In none of the three samples was a marked corresponding cynicism apparent: both headteachers and teachers agreed only slightly that the effects of projects was to

> "appeal to band-wagon participation by teachers,
> provide a means of promoting personal status,
> and promise more improvements than could reasonably
> be expected"[3]

The items with which headteachers[4] most strongly agreed (means 4.0 and over on a five point scale) were the following:

> "on the whole the effects of curriculum development
> projects have been to:

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1. See Chapter 10
2. See Appendices P (i) and (ii)
3. See Appendices P (iii) and (iv) for frequency counts and means.
4. The responses of both samples of headteachers were very similar, (only two items showing a significant difference at the 5% level and none at the 1% level).

> "improve the quality of pupils' school experience,
> support those teachers who are already attempting to bring about change in the schools,
> provide resources from which teachers may select,
> introduce new methods of teaching into the schools,
> demonstrate how new subject matter may be introduced into the schools,
> and widen the aims and objectives of teaching a subject".

They did not, on the whole, agree (means below 3.0 but none less than 2.0) that the effects had been to

> "introduce uniformity into schools,
> support classification of children into groups,
> maintain specialist divisions between subjects,
> promote dissatisfaction with what has been tested over time........,
> provide packages that can be fully adopted,
> discourage innovation because of the multiplicity of projects,
> or enable an atypical group to impose unrealistic standards on the school population".

There were no highly significant differences in the responses of heads and teachers on these items overall. This indicates a positive acceptance in the schools of the curriculum development project as a source of leadership and support in the educational enterprise, creating some problems, but causing little threat.

The heads also strongly agreed that the burden of preparation for teachers was increased. In this the strength of their agreement was, interestingly, significantly greater than that of the teachers.[1]

Only seven other items showed significant differences of opinion between science teachers and headteachers. The strongest disagreement was concerned with the influence of projects on the internal organization of schools. The teachers were, on the whole, undecided, while the heads definitely agreed that they had been influential. One may suggest two possible reasons for this: one that the heads had in mind projects other than those in science, or, alternatively, that science teachers were less aware of the causes of changes in time-tabling, streaming, etc., which were often initiated by the head.

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[1] The response here, together with responses to items referring to teaching staff in Section 8, of the headteacher questionnaire, suggest the headteacher's appreciation of the efforts made by teachers and a sympathetic concern for the demands made on them. This was reflected, too, in the refusal of one head master "to expose his staff to the extra burden" of a day of interviewing in the case study programme.

Smaller disagreements occurred over the use in the projects of behavioural objectives and theories of learning. The heads recognised the use of these more strongly than did the teachers. On the other hand science teachers detected more influence of projects on examining boards. It may be that this effect was more apparent in science projects in 1972/3 than for projects in general, or, alternatively, headteachers are less aware of detailed changes in examinations than are the teachers who are directly involved in the preparation of pupils for the examinations.

Outcomes of science education

It is possible to gain some insight into teachers' perceptions of projects from their responses to Section 7[1] of the teacher questionnaire.

The means of all responses are given in Table 16.2, the statements being in order of ranked means for the teachers' own opinions of the importance of the stated outcomes.

Except for items 3, 4, 7 and 14 the teachers perceived that the projects gave less importance to the outcomes than they did themselves. It is almost as if the teachers were indicating that they could have done better themselves, and reflects their sense of professional competence.[2]

To the teachers the most emphasized features of projects were the development of experimental skills, the ability to investigate open-ended problems and an understanding of and ability to use the scientific method.[3] These were also important for the teachers themselves, together with the development of critical attitudes to the effects of technology, but

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[1] In this section some of the possible outcomes of a pupil's experience in science were listed and the teachers requested thus "we would like to know the extent to which your opinion of their importance compares with the importance given to them by the curriculum development project(s) with which you are most familiar"

[2] This was detected, again, in the case study analysis of teachers' perception of projects as "intrusion into their arena" (see later in this chapter).

[3] The response to this item was interesting and may indicate the restrictions of a questionnaire investigation. It was anticipated that many teachers would reject the item in the light of recent debates about the nature of science and the absence of a singular "scientific method", but the high rating given to it suggests either that teachers are unsophisticated in their acceptance of a scientific method or that they are tolerant of the ineptitudes of questionnaire designers.

**Table 16.2** **Teachers opinions of the importance of stated outcomes of science education compared to their perception of the importance given to the same outcomes in the project with which they were most familiar**

| | Personal | | Project | |
|---|---|---|---|---|
| Outcomes of science teaching[2] | mean[1] | ranked mean | mean[1] | ranked mean |
| 1. Knowledge of the basic facts of science | 4.2 | 1 | 3.5 | 5 |
| 2. Ability to investigate open-ended problems | 4.1 | 2 | 4.0 | 2= |
| 3. Experimental skills | 4.0 | 3= | 4.2 | 1 |
| 4. Use of the scientific method | 4.0 | 3= | 4.0 | 2= |
| 5. Critical attitudes to the effects of technology | 4.0 | 3= | 3.2 | 12= |
| 6. Use of science in everyday life | 3.8 | 6 | 3.5 | 5= |
| 7. Creative solutions to problems | 3.7 | 7= | 3.7 | 4 |
| 8. Ability to delay conclusions | 3.7 | 7= | 3.4 | 8 |
| 9. Preparation for future studies | 3.6 | 9= | 3.4 | 8= |
| 10. Responsibility for own learning | 3.6 | 9= | 3.4 | 8= |
| 11. Social implications of scientific discovery | 3.6 | 9= | 3.0 | 14= |
| 12. Ability to work together | 3.5 | 12= | 3.2 | 12= |
| 13. Understanding theoretical concepts | 3.5 | 12= | 3.4 | 8= |
| 14. Favourable attitudes to science | 3.4 | 14 | 3.5 | 5= |
| 15. Individual's contribution to a group | 3.1 | 15= | 3.0 | 14 |
| 16. Educational benefits of individual sciences | 3.1 | 15= | 2.8 | 16= |
| 17. Supply of scientists and technologists | 3.0 | 17 | 2.8 | 16= |
| 18. Critical attitude towards authority | 2.7 | 18 | 2.4 | 18 |
| 19. Competition with other countries | 1.9 | 19 | 1.8 | 19 |

---

[1] 5 very important
4 of considerable importance
3 of average importance
2 of some importance
1 of no importance

[2] See appendix P(ii) for full statements of outcomes

the most significant outcome for teachers was *a knowledge of the basic facts of science*. These last two items and *an understanding of the social implications of scientific discovery* provided the largest differences between teachers' own views and those they detected in projects.

The teachers, in general, perceived that science projects were primarily concerned with developing investigational skills. They themselves, while valuing these outcomes, reported as equally important the factual content of science and its social implications.

The means used in the discussion above were derived from the whole sample population of teachers, when their attention was directed to the project with which they were most familiar. To see how representative these were of a group referring to a single project the responses of the three groups of specialist science teachers, naming the relevant Nuffield O level project as the most familiar, were examined.[1]

The biologists resembled all teachers in most mean responses; they were, perhaps, even more concerned that their pupils obtained *a knowledge of the basic facts of science*, but attached less importance to *an ability to investigate open-ended problems*. The largest variation occurred, however, in the mean responses to item 8: the biologists included among the most important outcomes for themselves *the ability to delay conclusions until convincing evidence is available*.

These three items also distinguished biologists from the specialist groups of chemists and physicists. Other items receiving more emphasis from biologists than from the other two groups were *the ability to work together*, *an appreciation of the individual's contribution to a group*, and *the ability to take personal responsibility for planning and conducting one's own learning experiences*.

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[1] See Table 16.3

It is possible that the biologists saw their science as complex, highly dependent on a mass of inter-relating evidence (facts), that requires the ability to delay conceptualizing until an adequate structure has been assembled. It would be interesting to enquire whether the greater emphasis on social values and responsibility shown by biologists was influenced by the nature of the subject or the probable greater incidence among them of women teachers.

The biologists perceived that the Nuffield O level project placed a greater emphasis on the investigational skills than they did themselves, but it was less likely to lead to a knowledge of biological facts and an understanding of theoretical concepts than they would wish. It did not seem to match their concern for "social" outcomes.

Altogether, in twelve of the nineteen stated outcomes of science education there was a significant difference between teachers' own ratings of importance and the importance they perceived in the Nuffield O level biology project; eight of these were highly significant and in two of these the biologists perceived that the project gave a greater importance to the outcomes than they did themselves.

The chemists resembled the whole population of teachers in the overall pattern of mean responses to both personal and project measures of importance of outcomes. Four items, however, showed some difference in ranking: for the chemist an understanding of theoretical concepts, preparation for future studies and a supply of well-qualified scientists and technologists were ranked somewhat higher than for the whole sample. They perceived that the Nuffield O level project gave a corresponding importance to the first two, but not to the last. The ability to use science in everyday life, on the other hand, was less important to the chemists, who saw it as ranking lower also in the project. This last item distinguished chemists from biologists and physicists, as did a slightly greater importance reported for the ability to investigate open-ended problems. These differences suggest that the chemists perceived their science as being highly structured theoretically, requiring careful foundations and having limited everyday use.

Table 16.3 A comparison of the mean ratings[1] of specialist science teachers own opinions (T) of the importance of outcomes of science education and the importance they perceive as given to the same outcomes in the relevant Nuffield O level Projects (P)

| Outcomes of science education[2] | Biologists N=66 | | Chemists N=73 | | Physicists N=71 | |
|---|---|---|---|---|---|---|
| | T | P | T | P | T | P |
| 1. Knowledge of the basic fact of science | 4.4 ⟸ | 3.5 | 4.1 ⟸ | 3.3 | 4.2 ⟸ | 3.6 |
| 2. Ability to investigate open-ended problems | 3.9 ⟹ | 4.3 | 4.1 | 4.0 | 3.8 | 4.0 |
| 3. Experimental skills | 4.1 ⟹ | 4.5 | 4.1 | 4.2 | 3.7 → | 4.0 |
| 4. Use of the scientific method | 4.2 | 4.2 | 4.1 | 4.0 | 3.9 | 3.9 |
| 5. Critical attitudes to the effects of technology | 4.0 ⟸ | 3.3 | 3.9 ⟸ | 3.1 | 3.7 ⟸ | 2.6 |
| 6. Use of science in everyday life | 3.9 ⟸ | 3.4 | 3.6 ⟸ | 3.3 | 3.9 ⟸ | 3.4 |
| 7. Creative solutions to problems | 3.6 | 3.7 | 3.7 | 3.6 | 3.8 | 3.8 |
| 8. Ability to delay conclusions | 4.1 ← | 3.8 | 3.5 ← | 3.2 | 3.3 | 3.3 |
| 9. Preparation for future studies | 3.6 | 3.5 | 3.7 ⟸ | 3.3 | 3.7 | 3.5 |
| 10. Responsibility for own learning | 3.9 ⟸ | 3.4 | 3.5 | 3.3 | 3.3 | 3.3 |
| 11. Social implications of scientific discovery | 3.8 ⟸ | 3.4 | 3.5 ⟸ | 3.0 | 3.3 ⟸ | 2.5 |
| 12. Ability to work together | 3.6 ← | 3.2 | 3.3 | 3.0 | 3.1 ← | 2.9 |
| 13. Understanding of theoretical concepts | 3.6 ← | 3.1 | 3.6 | 3.7 | 3.7 | 3.8 |
| 14. Favourable attitudes to science | 3.3 | 3.3 | 3.5 | 3.4 | 3.6 | 3.8 |
| 15. Individual's contribution to a group | 3.2 | 3.0 | 2.9 | 2.9 | 2.9 | 2.9 |
| 16. Educational benefits of individual sciences | 3.2 ← | 2.9 | 3.1 ← | 2.9 | 3.0 | 3.0 |
| 17. Supply of scientists and technologists | 3.0 | 2.9 | 3.3 | 2.9 | 3.2 | 3.1 |
| 18. Critical attitude towards authority | 2.8 ← | 2.5 | 2.7 | 2.4 | 2.4 | 2.2 |
| 19. Competition with other countries | 1.9 | 1.7 | 1.6 | 1.7 | 1 8 | 1.8 |

⟹ Difference significant at the .01 level or less

→ " " between .01 and .05 levels

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1. Ratings as for Table 16.2

2. See Appendix P(ii) for full statements of outcomes

In seven items (all but two showing highly significant differences) the chemists rated their own emphasis of importance of outcome higher than the project's emphasis.

Physicists differed from all teachers in the sample in that, as a group, they tended to give outcomes lower personal ratings. The five most important to them were a knowledge of the basic facts of science, the use of the scientific method, the use of science in everyday life, the ability to investigate open-ended problems and the confidence to propose creative solutions to problems.

Together with chemists, the physicists ranked the preparation for future studies and the understanding of theoretical concepts higher than did biologists. (This may reflect the current, greater vocational use of the physical sciences). They were less concerned than were biologists and chemists to develop experimental skills, although they saw this was of considerable importance in the Nuffield O level project.

In only four items did the physicists perceive that the project showed less importance to outcomes than they did themselves. These were the knowledge of basic facts, critical attitudes to the effects of technology, the use of science in everyday life and the social implications of scientific discovery and in them the differences in mean between the teachers views and those they saw in the project were highly significant. Two other items showed some significant difference.

Physics, for these practitioners, appeared to be vocationally useful; factual content and theoretical concepts were important, as were exploration and creative thinking, but personal values entered less into the outcomes important to a physicist.

They perceived that the Nuffield O level projects matched their own emphases in all but the lack of factual content and its seeming insulation from life outside the laboratory.

Significant differences in means in Table 16.3 suggest that the biologists were less satisfied with the Nuffield O level Biology project than were the chemists with their Nuffield project, while these, in turn, were less satisfied than were the physicists.

This pattern of relative satisfaction with projects by physicists, chemists and biologists matches the emerging pattern in 1972/3, of relative full use of projects by candidates (Fig.5.1), but not so clearly with use by schools (Fig.6.7), which might be expected to reflect teachers' choices more closely, and where the chemistry project shows consistently greatest use over 1967-73.

Herron (1971), "assuming that the teacher is and shall remain a filter of sorts between curriculum writers and their materials and the student who forms their potential consumer market", generates a simple model with three elements:

1. the point of view embodied in the materials,
2. the teacher's perception of these views,
3. the teacher's own views.

The application of this model can lead to four situations:

a) 1. and 2. agree, but not with 3.
b) 1. and 2. agree and also agree with 3.
c) 1. and 2. vary but 1. and 3. match
d) 1. and 2. vary and 1. and 3. vary.

No attempt has been made in this study to determine the point of view embodied in the materials, the assumption being that for decision-making the important relationship is between 2. and 3. If there is agreement between 2. and 3., there is more likely to be a decision to adopt than if there is disagreement. However, unless 1 and 2 agree, the adoption may not lead to the practice intended by the curriculum writers.

## The Case-Study investigation of teachers' perception of projects

Within the case study programme it was possible to attempt a more comprehensive exploration of teachers' perception of certain projects. The six projects chosen are shown in Table 16.4. They provided a useful range in ability of target population, in length of time that had elapsed since publication and of specialist or integrated science programmes.

Table 16.4 Projects selected for Perception Studies[1]

| Project | Intended Ability Band | Intended Age Band | Publication date[2] |
|---|---|---|---|
| Nuffield O Biology ) | Upper Ability | 11 - 16 | 1966 |
| " O Chemistry ) | band leading | 11 - 16 | 1966 |
| " O Physics ) | to GCE O level | 11 - 16 | 1966 |
| " Secondary Science | less able (CSE) | 13 - 15,16 | 1971 |
| SCISP | O level | 13 - 16 | 1973 |
| Nuffield Combined Science | all abilities | 11 - 13 | 1970 |

As Appendix S(ii) shows, there were only two schools in the case study sample that had been described as secondary modern, but it was assumed that Secondary Science would have relevance for the comprehensive schools in LEAs (A), (B) and (C), the general secondary schools of (B) and the bilaterals of (C).

Using a check-list of questions[3] the teachers were asked how appropriate the project was for their pupils, what differences they perceived between the project and a more traditional course and what advantages and disadvantages accrued from the use of project materials. They were asked for their opinion of the published materials and special apparatus, of the cost of implementation and whether the development of the project had been worth while.

Most teachers interviewed were able to give some response to all these questions when the O level project appropriate to their own specialism was under discussion, but for some the familiarity with Secondary Science was too slight to warrant detailed questioning and when it came to SCISP a few teachers were not even aware it was being developed.

Summary statements representing the core of teachers' responses to the standard questions are reported in the Appendix[4] for each project, together with the code letter of the school(s)

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1. See Appendix S(i)D for discussion of choice of projects
2. Interviews for the case studies took place in 1973
3. See Appendix R(iii) for interview schedule
4. See Appendix S(iii)

in which the response was made. But the teachers not only answered the specific questions, they went on talking, elaborating their views, explaining their problems and making known their successes and disillusionments. The method of reporting, though achieving a degree of accuracy, fails to convey meaningful patterns. These developed for the interviewer as the case-study programme was pursued and an attempt has been made to identify a typology of stances assumed by the teacher towards a curriculum project in science.

The curriculum development project was perceived by all the teachers interviewed as an external object. A few actively sought after them; a few were ignorant of the existence of some of them; some recognised their relevance for others: for the majority of teachers the curriculum development project was a fact of life, a new pressure acting on them that could not be ignored but demanded a response, if only of rejection.

The various stances assumed by teachers are discussed below in general terms within which an attempt has been made to draw out the specificity to project and context, where this has been apparent to the interviewer. More extensive quotes are used than in reporting the response to questions, to give the 'flavour' of the teacher's stance.

The curriculum development project in science, whatever its special characteristics, can be seen by the teachers as:

welcome revolution,
intrusion,
powerful pressure on external constraints,
improved practice in schools,
the new orthodoxy,
solution to a problem,
mismatch to various factors in the school situation.

This typology is possibly not the only one that could have been formulated from the data, neither are the separate stances described mutually exclusive, but they do form some generalisation of science teachers' perceptions of the science curriculum development projects.

## A typology of teachers' stances to curriculum projects in science[1]

### The project as welcome revolution.

> "It was a breath of fresh air- an opportunity to think afresh and begin to teach science as it should be taught".
>
> "I felt stale with traditional O level and thought 'here's a chance to escape!' It looked pretty exciting and went down well".
>
> "At the time I wasn't aware of the need - I hadn't stopped to think. It took Nuffield to give me a kick in the pants! I came away (from the Loughborough Conference) - this is not an exaggeration - thinking about chemistry in an entirely new light.........
> energetics, structure and kinetics! One had thought of this as a research student, but had never considered it a starting point for teaching chemistry".
>
> "It has stimulated science teaching and done a fantastic job. From lecturing and providing information on a 'take-it-or-leave-it' basis the teacher's role is more of a problem poser and adviser, leading to help at the individual level. I praise the project for this. I wouldn't be in teaching if it weren't for the Nuffield course" (an Engineering Science graduate)
>
> "You see, I came into schools, without teacher training, as a middle-aged graduate. The syllabus wasn't much different from that I had followed at school! I felt the need for new ideas and materials, so when the Department of Education here arranged a Nuffield course I took advantage of it. It was a three-day course, entirely practical work, quite splendid! We were all thoroughly indocrinated with Nuffield ideas!"

For these teachers the relevant O level project had provided the lead to which they had responded with leaps of recognition.

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[1] Jenkins (1974) uses a similar framework for discussing the social relationship between a project and its trial schools. He identifies the guiding metaphores that were generated as:

| | |
|---|---|
| The exchange of gifts: | The project as reciprocal obligation. |
| The other drummer: | The project as unselected affinity. |
| Troubled waters: | The project as agitation or distress. |
| The gift of grace: | The project as salvation. |
| The props for identity: | The project as theatre. |
| Free sample: | The project as commercialism. |
| Ground bait: | The project as exploitation. |
| Taking issues: | The project as management consultancy. |
| Cargo cult: | The project as overwhelming technology. |

This account may be found in Shipman (1974) "Inside a Curriculum Project".

The revolution had two components. One was related to subject matter: a re-interpretation of school science in terms of the modern discipline. The other was related to teaching methods: a change from the didactic teaching of facts to more experimentally-based, discovery learning which, for some, was again related to the modern discipline. Only a few teachers interviewed had been involved in the trials of the O level projects, but, from their comments, it seems possible that it was the changes in what was to be taught that were most visible to them in the early days, whereas for those who met the project later it was the methods - "the Nuffield approach" - which constituted the greatest difference between a Nuffield course and a more traditional one. One may suggest several reasons for this: the trials' teachers may have been selected because their current practice was close to the methods recommended, while more recent changes in the content of other syllabuses have left the "traditional" courses more similar in content to the Nuffield courses, so that the method remains the visible characteristic of "the Nuffield approach".

Some teachers recognised revolution without actually welcoming it:

> "at the beginning I was terrified, as you'd taken away all my physics"
> "it alters the whole organisational task of the teacher".

For others it was less than revolution:

> "the influence of Nuffield on me would have been greater had I not already been in sympathy with that kind of thinking".
> "I was irate with Nuffield when it was suggested that others were old-fashioned. Everyone tries to keep up with the times".
> "There was always good physics teaching in this country. It has enabled good ideas to spread".
> "There's no difference: there's nothing wrong with traditional courses".

Only rarely did Nuffield Secondary Science promote an enthusiastic response.[1] The change in orientation required to embrace an integrated

---

1. In the judgement of an H.M.I. and project team members, in none of the areas visited had the Nuffield Secondary Science "taken" well.

science course for older pupils was more radical than most teachers were prepared to entertain. However some (usually younger) teachers were disciples of its revolution:

> "I welcome it as the first course that sets out to be for the less able, rather than watering down academic courses"
> "The value of Secondary Science is that it is more relevant and it can make science interesting"
> "The emphasis has been too much on the academic. Its approach should be used for all. Why should the brightest be fobbed off with academic science?"

The emphasis on social problems in SCISP made it remarkable for a few teachers, but for only one was its use of a special theory of learning visible enough to warrant a comment.

The project as intrusion

To a few senior teachers - well-established heads of science departments - the projects were seen as an intrusion into their arena:

> "I don't throw out of the window all that (indicating a large file) just because there's a new scheme. If you have somebody quite incompetent or lazy he might be pleased to take on a standard laid-down course"
> "It doesn't give me the freedom to exercise my professional expertise"

It is apparent that these teachers perceived the projects as complete packages and, as such, rejected them. Others exerted their "professional expertise" and modified, as did one head of science who, while entering candidates for the Nuffield O level Biology examination, commented:

> "We've modified so much that I can't even remember what is in the texts!

The project as powerful pressure on external constraints[1]

> "Having seen what it's done to traditional courses, yes, there was a need (for the project). Exam. boards have changed in syllabus content and in methods of examing".
> "I know it's been taken up by teacher training establishments as I've just come from one after university. They're flogging it ten to a dozen!"
> "The materials are expensive, but Nuffield has status and education committees have tended to take a favourable view".

---

[1] See discussion in Chapter 4 of the influence of the O level projects on examination boards and books published since 1966.

> "It has encouraged suppliers to come up with apparatus".
>
> "One effect of Nuffield is on publishers and the way they've written their textbook. No longer can one sell a text book that gives instructions, results and formulae, one can't get a pupil's book that gives background".

Again, it was the O level separate science projects that were generally perceived as influential. They were first in the field, and captured public attention. They were directed at the able pupil entering public examinations and fitted both the organisation of the schools at the time of publication and the identities of science teachers. That Secondary Science and SCISP do not appear to be exerting similar pressures raises questions about the effectiveness of projects as they become institutionalised, the status of the not so able, the status of the non-specialist course and the nature of the change embodied in a project.

### The project as improved practice in schools

> "The old courses had no flavour of biology. Before, they learned facts as in geography or history, now they can learn to operate as a biologist. I was a keen biologist in spite of my school biology"
>
> "If you don't have to stress recall you can teach"
>
> "The kids can think deeply and intuitively in a way I couldn't at school. I am very pleased with what it turns out. It brings the truth of a subject to them earlier"
>
> "A lot have a much better understanding of what science is about. Our present third year, who have done two years of Combined Science are more questioning and much more interested"
>
> "We're finding a marked difference between our first year Nuffield and our second year who are just on the ordinary scheme.... the difference is remarkable - the first year get their material out and get on with the work themselves. ..... whereas the second year is relatively helpless"

Within this group (users of Nuffield materials), were those who in common with the "revolutionaries", made an intellectual assent to the projects as recommending improved practice and those who, using them cautiously, were recognising desirable changes in their pupils.

These teachers were likely to continue to use the materials and to act as change agents in influencing others:

> "I was persuaded partly by their keeness (trial schools) and partly by what I saw in the materials".

For a disquieting number of young teachers the mere use of experimental work was improved practice, for they reported of their own experience: "we didn't do practical work until the sixth form", and "when I was at school our science was blackboard based; we'd perhaps do an experiment once in eight weeks"

One head of science reported a change in his use of practical work:

> "when I started teaching here I'd be putting "Preparation of oxygen" as a title on the board. Now I don't even give a title - we discuss a problem and they explore. It's now an exploring science".

Most teachers recognised that the projects had resulted in an increase in practical work done by the pupils; not all were entirely happy with the outcome:

> "I always get the feeling that the boys have had a good time messing about with the equipment and doing experiments, but in the end, when we sit and think, I feel personally that in many cases we haven't really managed to put across any scientific ideas, especially as most of them have difficulty in making their own deductions. So, though they have enjoyed themselves, I am left with the sneaking feeling that not very much has been achieved, except perhaps in things like technique and familiarity with apparatus and superficial things like that".
>
> "I have known young teachers to hide behind the apparatus - chalk and talk has its place!"
>
> "Using discovery methods children often feel out on a limb - where are we going - where have we come from and why are we here?"
>
> "There are problems for the young teacher- there's more freedom for dare-devils and cheek, rewarded by peers. It's expecially difficult when apparatus doesn't function as it ought".

These comments express both a concern about the qualities that a teacher needs to use the materials and approach effectively and a continuing uncertainty or conflict about the outcomes of science education. "Learning the facts of science", reported as important in the questionnaire replies, appears to be in conflict with the increasing use of pupil practical work. It is significant that in several of the schools using Combined Science teachers referred to problems of assessment and some had abandoned examining in science courses in the early years.

## The project as the new orthodoxy

The stance assumed by the teachers who, on the whole, were not using project materials, but who recognised the changes embodied in their use, was as observers of a new fashion:

> "You can't really tell what the objectives are with some of the projects - they just seem to say 'this is the new way of doing things'".
>
> "It's Armstrong's heuristic method - I don't attribute it to Nuffield.... Nuffield has caused some teachers to use it more than they would have done because it's in the Guides and carries authority".
>
> "The decision to do Nuffield O level Physics has been taken by the Science Adviser..... the overall picture is that one is bound to take over Nuffield work".

One head of a large department was

> ".....concerned over the effect it seems to have had on teachers - it's stifled inventiveness; the S.S.R. Biology Notes have contracted and we haven't invented a piece of kit for years".

Another feared

> "..... there's a danger that these courses will stagnate like the traditional did".

Only a few saw SCISP or Secondary Science as the new orthodoxy:

> "Some kind of integrated science is next on the list".
>
> "All I know is that it's based on Gagné's Theory of Learning. I feel that whatever it is I shall like it - I'm a fairly integrated sort of bloke and am willing to learn" (a probationer).

## The project as hard labour

Although, in the questionnaire, teachers did not agree as strongly as head teachers that projects had increased the burden of preparation for teachers, some of those interviewed perceived the familiarizing of themselves with project materials, the planning of their use and sometimes their continued implementation an intolerable burden.

> "The amount of material circulating about these projects was pretty daunting - a lot of reading had to be done and checking apparatus. I was glad not to be in a project school".
>
> "There's such a mass of material that it takes time to assimilate even one theme" (Secondary Science).
>
> "How do I see SCISP? - as an added burden!"
>
> "It's harder work and I felt Nuffield shouldn't be. The books are difficult - you have to sit down and read. I need something I can glance at".
>
> "It would drive me mad - I wouldn't have time to do it. I went to a school where a man was doing Nuffield Physics. He was spending all his time getting apparatus ready. He was becoming a nervous wreck. The demands on the teacher are fantastic".
>
> "The involvement required to get Combined Science fully and properly off the ground was really very considerable. Staff felt they did not want school to encroach on their own time and home-life. The head of science needed a camp-bed four nights a week in the prep. room - it was that level of demand".
>
> "It involves more work initially, but now I give no thought to what I'm going to teach. I write out a requisition for apparatus at the beginning of the week, keep a carbon copy and just glance at it before going into a lesson. But all hell breaks loose when the technician is away - then you are sweating".

In other schools there were comments that lab. technicians were complaining about "the work it involves", and one head of science remarked sadly that "technicians" courses did not train them to cope with discovery-learning".[1]

Some saw that the demands were made on the pupil also:

> "It's enormously slower, resisted fervently by pupils not used to it. It leads to most chaotic classroom situations (as viewed from outside) and makes the job of teacher very much harder".
>
> "There is much greater demand on the child. Commitment is required, he can't sit at the back and switch off".

---

[1] The interviewer obtained a vivid insight into the loss of job satisfaction suffered by his technician - an ex-service man, who had prided himself in anticipating the teacher's every need in a tightly sequential course - when the school adopted Combined Science and discovery learning.

## The project as the solution to a problem

Just occasionally, in addition to the response of the revolutionaries, who gave intellectual and professional assent to a project, a school perceived in a project the solution to a problem - it appeared to match their need. This was sometimes an organisational problem and sometimes a discontent, created perhaps by a prevailing climate of opinion:

> "We were looking around for something to replace our general science course when a new colleague suggested Combined Science".
> "We do Combined Science. We were a new school, we wanted to run an integrated course, as with only four periods a week, we didn't have time to do the three sciences".
> "I wanted a unifying course to bring us all together, help us not to diversify, with a common syllabus to bring skills and energies to bear.... We already had Secondary Science so a SCISP-type course would fit well into this, and we've only been given a double period in each subject in the fourth year, so time-wise SCISP would fit better".

## The project as mis-match

By far the largest number of all comments about the curriculum development materials in science emphasized the lack of congruence perceived in their design and the characteristics of the situation in which their implementation was intended.

## The project as mis-match to school organisation

> "So many of these schemes don't fit into our school organisation".
> "They can't choose to do physics until the end of year three and this rules out Nuffield which is a five year or a three year course".
> "We'd have had to rewrite the third year as the general policy in the school is mixed ability".

It was assumed by many that all three O level projects were designed on a 2 plus 3 years organisation and for many schools year 3 was seen as problematical: they were prepared to follow an undifferentiated year 3 with a "traditional" separate science O level, but not with a Nuffield project. This was not true, however, in LEA (A) in which the upper schools received pupils into year 4 and yet were high users to examination of the Nuffield courses.

In addition, schools Aa, Ab and Bb had confidently adapted the Nuffield O level materials to individualized learning, some leading to the Nuffield examination and others to a similar examination for another board.

> "The money is split three ways between the three main departments with a little left over for general science, so Secondary Science materials would have to justify its use in a specialist department before it was purchased".

The barriers presented to integrated science courses by the organisation of science into physics, chemistry and biology was frequently mentioned, especially where the different laboratories were distant from each other, making movement of apparatus difficult.

### The project as mismatch to resources

> "We were offered £200 when we needed £2000 so it wasn't on".
> "We haven't enough petty cash. The grant goes on major items but some experiments need homely apparatus and we haven't the petty cash to get it".
> "I quoted the figure given in the project to equip for one year's work. I was offered £80, so bought one kit to use in as wide an area as possible".
> "Much of the C.S.E. work is not taught in laboratories".
> "Our labs. have fixed benches and were not designed for this kind of work".
> "I don't use the methods here. I am far too busy covering the syllabus. I'm not saying that the children would get much benefit or would be able to carry out very meaningful investigations, but there's not time even to try".
> "We're limited by time and we're limited by money - I don't feel I can waste time or money so practicals are done only where I can see a definite end-point in view".

The availability of special grants to launch projects in schools in perhaps the most effective facilitator of science projects. This certainly emerged from the questionnaire study[1] and was apparent in the case study areas, where grants were freely available in LEA s (A) and (D)

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1. See discussion in Chapter 14

but limited in amount in (B) and not offered in (C) until after the science inspection. However, even in (A) and (D), reasons of mismatch, other than limited resources, were quoted for non-adoption.

Laboratory space available can be limiting on any science course, but school B demonstrated that, with only four labs. and ten classes timetabled at one time, an exciting programme of investigational work could be carried out.

The perception of time available was very much a personal, relative thing, but many teachers were sure that an investigational approach was a more time-consuming method of reaching a given knowledge end-point than a more formal didactic approach.

## The project as mismatch to pupils' abilities and needs

> "I would use it for the top 5% (10%,12%) at the most".
> "I wouldn't dream of using the books, not even for an O level group - they're much too difficult".
> "I've never been convinced that it was for the average pupil - it's for the brightest - more conceptual. The average boy can't tie a lot of ideas together. They need a lot of rote learning".
> "Less able kids and the ordinary teacher are easier to tune with a traditional course and way of teaching than with a Nuffield course and approach".
> "It's easier to get an O level qualification with J.M.B. Biology than with Nuffield. We keep thinking we ought to stop putting them in for J.M.B. but we haven't got the courage to change.... We have a responsibility to the pupils and to their parents".
> "From the science point of view it's much better if they think, but from the parents point of view, for careers, they need an O level".
> "Employers only recognised separate science qualifications".
> "Boys need physics O level".
> "We don't like to label kids too early".
> "Girls, particularly, like to sit there and have it drilled into them and then spout out".
> "Girls are happiest sitting with a text-book and learning".
> "Girls sit back and receive ideas".

> "Intelligent girls don't need the discovery approach - they can see the answers and feel a lot of the experiments are a waste of time".
>
> "The difficulty is tuning them into the sort of questions Nuffield sets. They are conditioned by all the other subjects to learn and regurgitate facts. Time after time they come out of the exam. and say 'if only I'd known it meant that'. They've done a lot of hard work and don't feel they've done themselves justice".

The perception behind these comments is that the Nuffield course, as set out in the texts, followed by the Nuffield examination, is more difficult for pupils, especially girls, to follow successfully. Few teachers were aware of the pass rates for the Nuffield examinations[1], and many were going on hearsay, but two chemistry teachers (one of boys, the other in a mixed school) had kept records of pass rates over the years and both claimed improved performance with the Nuffield course. On the other hand two biologists (both in mixed schools) were discontinuing the Nuffield biology course for some or all pupils because of a low pass rate.

In addition qualifications in integrated science were perceived as carrying little weight with employers. Integrated science was more desirable for the not-so-able, but there was a reluctance to label a child thus too early.

## The project as mismatch to further study needs

> "The Nuffield course doesn't have the factual content necessary for understanding chemistry".
>
> "We had to teach the sixth form to write answers".
>
> "The universities have to give the Nuffield students special coaching".
>
> "Colleagues felt SCISP didn't give enough basis for A level work so we dismissed it".
>
> "People are specialists at heart".

These, and comments like them, indicate that the pressure in schools is still often downwards from the university, through the sixth form, to work in the 11 - 16 age range.

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1. See the discussion in Chapter 5

Where a project was seen as a package it could be readily rejected if the match was not perfect. Where it was interpreted as resource material, or essentially as an *approach* to teaching science, materials could be selected and modified. But if the *method* was perceived as inappropriate, then "ideas for experiments" were all that was taken from the materials.

The selection of the "cherries" from the materials was likely to be made, as one teacher put it, in terms of:

> "what appeals to me, what I think will go
> down well with the kids and what fits with
> the apparatus we've got".

## The dependence of perception on context

The dependence of perception of a curriculum project on the context in which the teacher finds himself may be illustrated by the perceptions of Nuffield O level Chemistry found in three areas.

In LEA(A), where the general expectation for the use of projects was high, no personal leadership within chemistry had emerged early in the diffusion of the projects, as had happened in biology and physics. Of the schools visited only the newer ones or those where the head of department had changed recently were using the project. Most heads of chemistry had resisted the change. No strong professional discontent had been generated to cause them to welcome the Nuffield course as revolution; they remained content with existing practice.

In LEA(B) the presence of outspoken criticism of the Nuffield sample scheme in the local Institute of Education produced a perception of it as not emphasising principles or creating a sound theoretical background for further study - a perception not found in other areas, although the latter outcome emerged as an important difference for chemists in the questionnaire study. (See Table 16.3)

On the other hand, in LEA (C), following a strong lead by a local teacher when it was published, the chemistry project was the one most frequently used and considerable satisfaction with it was expressed.

Physicists in LEA(A) showed considerable professional independence and pride that seemed related to the early lead taken within the LEA in connection with the teaching of modern physics. They identified themselves with pre-Nuffield innovations in physics teaching (this held even for some young teachers who had entered teaching since the Nuffield projects were published) and led to informed criticism of the physics project, but, never-the-less, a high use of it.

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Norms of acceptability of practice are subtly created within a community of teachers and influence their perceptions of projects. This affects the stance teachers assume vis-a-vis projects and their adoption-decision.

## Conclusions

In pulling together all these responses by teachers to questions about curriculum development projects in science one may conclude that, in general, they were regarded favourably, especially when they were seen to have brought about desirable changes in external examination and released increased resources for science teaching. The perceived emphasis on pupil experimentation was welcomed as more in keeping with the real nature of science, but in practice this could create further problems. The finer perception of the projects was related to the assumed role of science education and this was still largely vocational.

From the foregoing analysis of the case study interviews it is suggested that few teachers make an objective assessment of a curriculum project.

In the following chapter it is argued that the teacher matches aspects of his world with the project and, at some point, his developing perception crystallizes into some stance such as those described earlier. The final perception may be influenced by the prevailing local orientation, or climate of opinion, and the realities of his situation, but is also dependent on a teacher's self-concept which constrains the response he may make to innovation. If he is resistant to change then the perception that crystallizes will justify rejection of the demands that the project makes.

A model of a process of decision making to use or reject project materials is proposed and discussed in the following chapter.

## CHAPTER 17

## DECISION MAKING: PRESSURES AND PROCESSES

The intention in the first part of this chapter is to expand and discuss the hypotheses that decisions affecting the curriculum are made at various institutional levels in selective response to felt pressures and constraints. In the second part a further model of the process used in decision-making at the teacher level is presented and discussed. Finally characteristics of teachers that affect the outcomes of decision-making are examined.

### LEA decision-making

In Chapter 9 a structural hierarchy of institutions was assumed:

D.E.S. —— L.E.A. —— SCHOOL

with the school broken down further into

HEADTEACHER —— HEAD OF DEPARTMENT —— TEACHER

Although curricular responsibility is ascribed by law to the governors of the school it has historically evolved to lie with the headteacher and the teacher. But decisions taken at earlier levels in the hierarchy constrain those taken later.

Kogan's[1] derived tasks for the LEA in England and Wales place it between the central government and the community it serves. The "world view" as seen from within the LEA, may be represented, as in Figure 17.1, as a series of pressures and constraints acting in upon the LEA; and only some of which are reciprocal.

It is of interest to consider how this arises. The local authority is set up orginally by central government Act; councillors are elected by the community; an education committee is formed from elected councillors and other community representatives. Administrative personnel are appointed, in the form of Chief Education Officer and assistants, and decisions are made and implemented.

Institutions (schools and colleges) develop to serve the community and the education department grows further to service the expanding system. Once established, the institutions develop some degree of autonomy, so that the world, seen from within the LEA, consists of a set of autonomons or semi-autonomous groups and institutions exerting competing, and sometimes conflicting, pressures upon it.

The decisions made by central government (represented by the rectangular boxes in Fig. 17.1) are inescapable and although they involve organisational changes or financial controls they have profound curricular implications.

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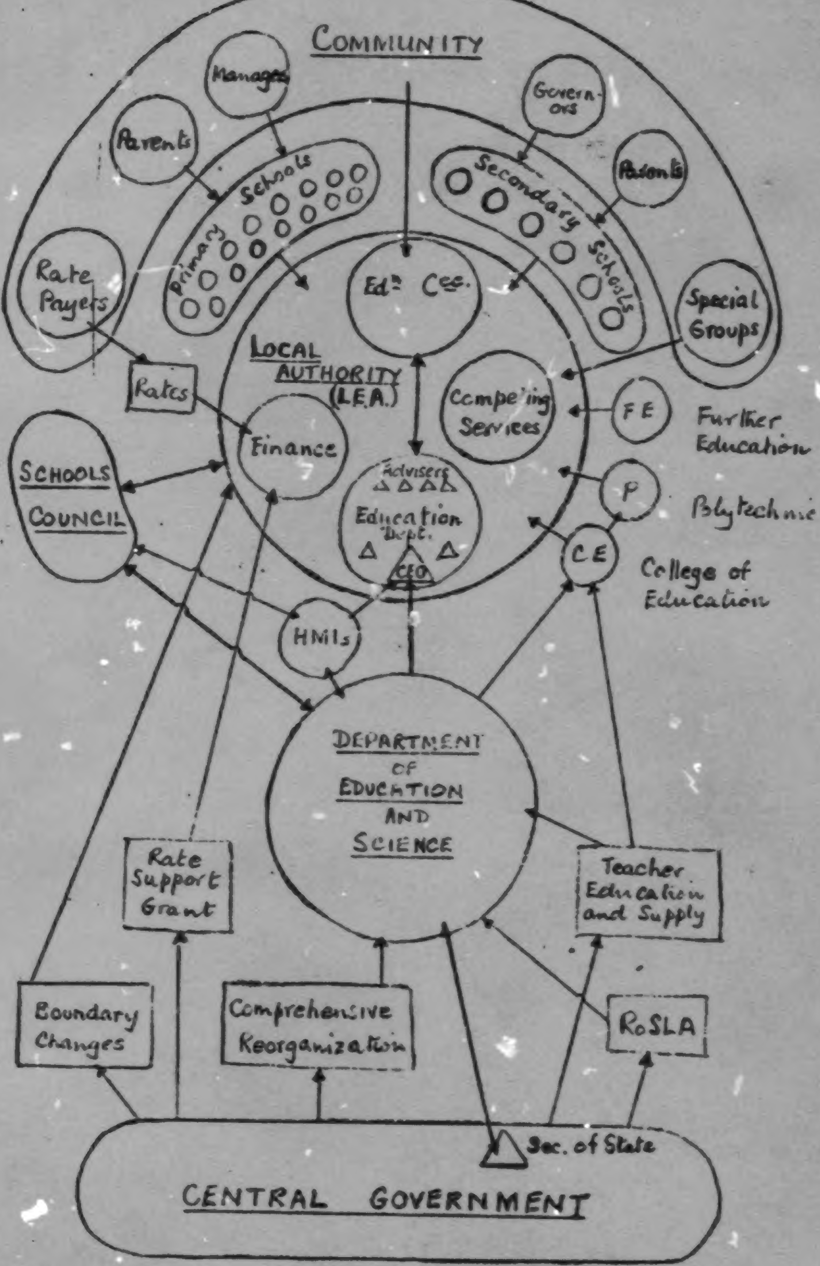
[1] See Chapter 9.

Figure 17.1 Pressures acting on the LEA in decision making.


COMMUNITY
Managers
Parents
Governors
Parents
Primary Schools
Secondary Schools
Rate Payers
Edn Cee.
Special Groups
LOCAL AUTHORITY (L.E.A.)
Rates
Competing Services
FE
Further Education
Finance
SCHOOLS COUNCIL
Advisers
Education Dept.
CEO
P
Polytechnic
CE
College of Education
HMIs
DEPARTMENT OF EDUCATION AND SCIENCE
Rate Support Grant
Teacher Education and Supply
Boundary Changes
Comprehensive Reorganization
RoSLA
Sec. of State
CENTRAL GOVERNMENT

J.H.
23.3.74.

For the LEA they are the legitimate sources of change[1], but the mode of responses to them may vary from a willing acceptance to a reluctant acquiescence. The response to a particular pressure, be it an invitation to submit plans for the comprehensive reorganisation of secondary education or for funds to implement a curriculum project, will depend on the interpretation of the educational task found within the LEA at the time and on the presence or absence in it of key persons to assume leadership or supply orientation.

Increased sensitivity to pressures may arise from the creation of specialised roles (e.g science adviser), but the degree of sensitivity depends on the role-incumbent's qualities.

While a model of response to pressures is proposed, it is recognised that leadership may arise within the LEA to initiate change and to exert pressure outwards from it to gain support from the surrounding institutions.

## The application of the model to case-study data

LEA(A) is one in which a tradition of initiation of change has developed. A planned reorganisation of secondary education was nearing completion in the early sixties and a comprehensive advisory service had been provided for the schools. Physics teachers were already meeting to discuss changes in the curriculum and had gained financial support from the LEA for new apparatus. Leadership in science education had emerged in the local University School of Education. Trial schools were established for the Nuffield O level Physics and Biology projects and, later, for other projects. The Science Adviser obtained the promise of annual financial support for the introduction of Nuffield projects over five years, through the high schools to the upper schools. This did not prevent some schools introducing the courses earlier, if they wished, but it created, for others, the impression that they were expected to introduce them, or forfeit the grant. The pressure was, in these cases, exerted from LEA to school. There was further evidence of the pressure acting this way in the efforts made by the Science Adviser to effect use of Nuffield Secondary Science in the Upper Schools[2], and in the assumption that schools would use Mode 3 CSE examinations.

In LEA(B) no new grammar school had been built for many years: the LEA's postwar policy had been to establish "general secondary" schools as increasing population made this necessary. It was not a wealthy authority and employed only two "inspectors" to carry responsibility for all work

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1. See discussion in Chapter 10
2. See discussion in Chapter 15

in all schools. When the Nuffield O level materials were published it co-operated with another LEA to provide inservice courses for its teachers, purchasing the relevant books for them.[2] When requests for funds to implement the projects began to be made the LEA decided to spread the limited money available, to give modest sums annually to all who requested support and demonstrated use for it. In this way many of the schools were able to build up apparatus for small groups over the years.

The LEA also set up curriculum development groups, in each chief subject area, convened by a senior teacher who acted as secretary for a year before handing over to someone else. This structure had enabled one head of science to exert pressure to gain support for a residential course for Nuffield Combined Science and out of this had grown the County Science Teachers' Association. Here was an LEA readily responding to pressures associated with the curriculum development movement from outside and inside the school system, creating a supportive, but limited, framework within which the schools were "free" to act.

Particular interest in modern mathematics was detected within the schools. A group of teachers, including some of science, had visited Sweden and interest had developed in the Swedish Mathematics Project. The LEA had experimented with the appointment of a teacher-adviser in mathematics to support this work and had planned to follow with one in science to co-ordinate the interest in and use of Combined Science. This plan was abandoned, however, when local government reorganisation decisions indicated the dissolution of the county. This, together with the probable destruction of the County Science Teachers' Association (a real "grass-roots" development), illustrates some of the curricular constraints of central government decisions.

The schools in LEA(C) had experienced difficulty in attracting and keeping well-qualified staff in mathematics and science. It was reported that information about science projects had merely been filed at the office as there was no person with a science background within the LEA administration. There had been a steady programme of courses for Nuffield Science Projects in the local School of Education from 1966, but few teachers from the LEA had attended them, and none had apparently requested financial support to introduce the materials into schools. There appeared

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2. It appears (from data from which the discussion on pp 8.10 and 8.11 is derived) that all but two of the LEAs schools were represented on these courses.

to be little sensitivity to pressure and little response.

A newly-appointed HMI (a biologist) set in motion an inspection in science in the LEA schools. The report recommended the use of Nuffield Combined Science, which the LEA and several of the schools accepted. At about the same time a Curriculum Development Centre was set up so that the reception of information about the most recent science project (SCISP) was into a different environment and one which resulted in response. The inspectorate, set up by central government but not of it, had exerted a pressure to move the system and a greater sensitivity to communications about curriculum projects had been created in the founding of a specialised institution.

Within the smallest of the case-study LEAs, (D), the administration appeared to have adopted a "laissez-faire" attitude to curriculum development but to have been responsive to pressures from schools and from outside the system. Grammar and Secondary Modern schools had persisted until 1973, with a low staff-turnover in science and professional commitment appeared to be high in both types of school. The LEA had responded to requests for financial support, when interest developed in Nuffield Chemistry, and, later, had contributed to the Centre for School Science and Technology at the University.[1]

## Decision-making in science education at the school level

When one shifts focus from the LEA to the school the world view changes. The immediate environment of the school is the LEA and the community, overlapping to give the Education Committee and the governing body. (See Figure 17.2). Central government and the DES have retreated and their decisions are mediated by LEA response; only HMIs are directly accessible and contact with them is rare.[2] In addition to parents, the community holds new sources of pressure: examinations, employers and, for science teachers, the science community, together with publishers and manufacturers, creating status for Nuffield Science Teaching Projects, all existing within a varying consensus of the purpose and style of education and of the image and role of science.

Pressures operate within the school also, creating the different world views of headteacher, teacher or pupil. This is displayed diagrammatically for the science curriculum in Figure 17.2, and shows the Head as the focus of a large variety of pressures originating from the education office, the governing body, parents, other headteachers and, most immediate of all, teachers, pupils and the school organisation (many aspects of which will be of his own shaping).

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1. See discussion in Chapter 15
2. See discussion in Chapter 10.

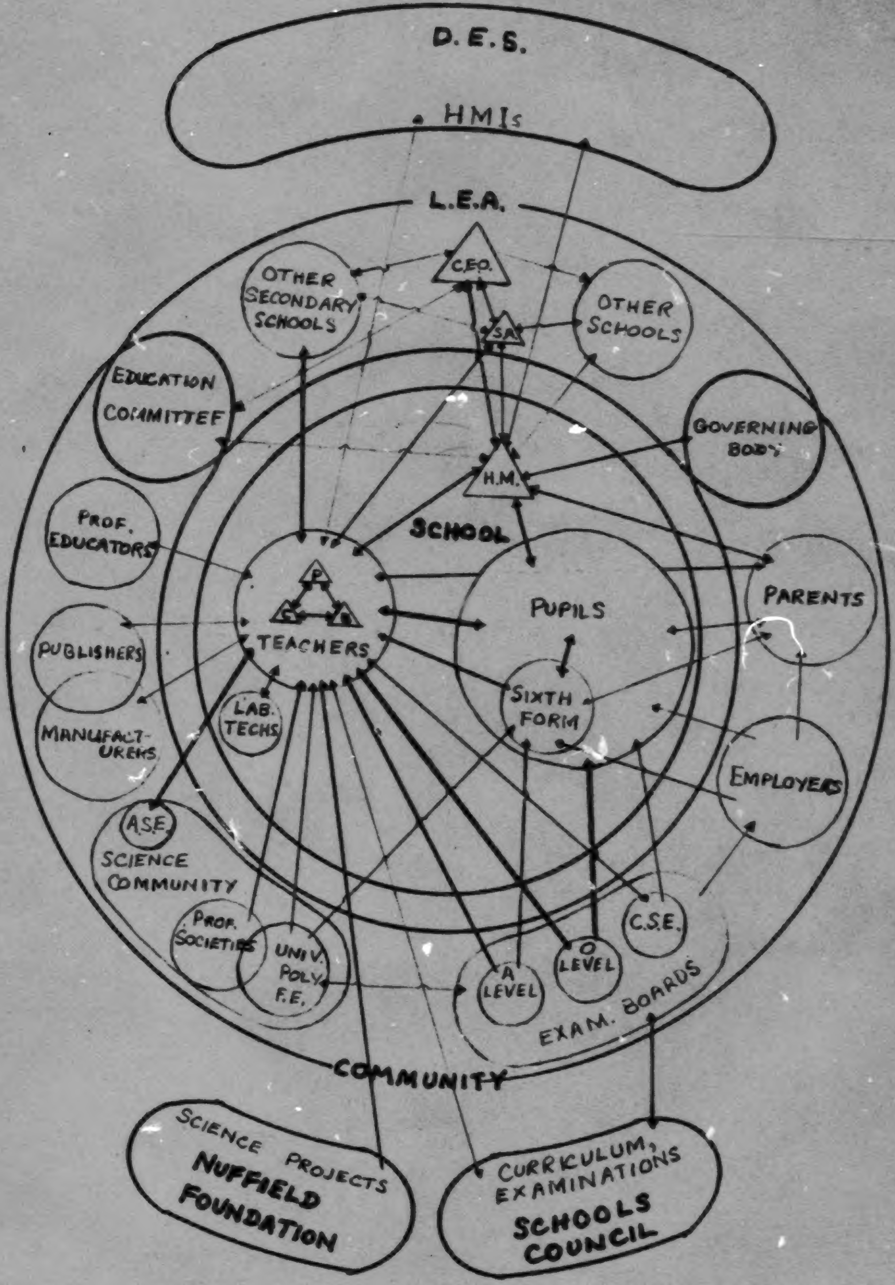

D.E.S.
HMIs
L.E.A.
C.E.O.
OTHER SECONDARY SCHOOLS
S.A.
OTHER SCHOOLS
EDUCATION COMMITTEE
GOVERNING BODY
H.M.
SCHOOL
PROF. EDUCATORS
P
TEACHERS
PUPILS
PARENTS
PUBLISHERS
MANUFACTURERS
LAB. TECHS
SIXTH FORM
EMPLOYERS
A.S.E.
SCIENCE COMMUNITY
PROF. SOCIETIES
UNIV. POLY. F.E.
A LEVEL
O LEVEL
C.S.E.
EXAM. BOARDS
COMMUNITY
SCIENCE PROJECTS
NUFFIELD FOUNDATION
CURRICULUM, EXAMINATIONS
SCHOOLS COUNCIL

Figure 17.2 Pressures acting on the school in decision making.

The world of the science teacher is created within the school by the pupils he meets, his colleagues, the technicians (or their absence), the headteacher (or committee structure to which he has delegated curricular responsibilities) and the accommodation, equipment and organisation of the school. Beyond this he experiences pressures from examining boards, the science community (in proportion to his exposure to it through membership of societies or other communication contacts), publishers and manufacturers (through the materials they produce) and parents, who mediate further vocational pressure from employers, who, in turn, selectively increase the pressure from examination boards by their emphasis on qualifications.

## A model of the process of decision-making in science education used by a teacher faced with a curriculum development project

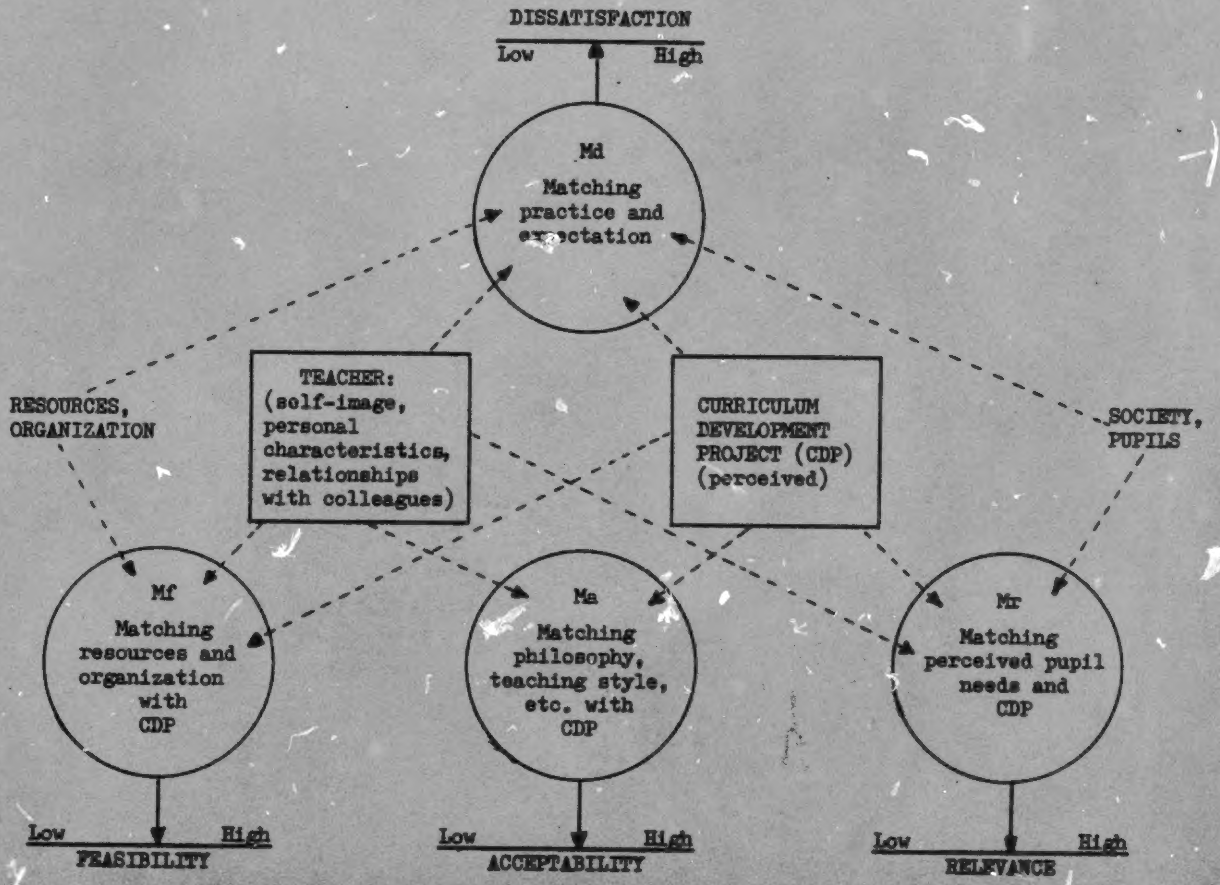
It has been proposed that the science teacher makes decisions about the curriculum within a frame-work of pressures to be accommodated. He may do this virtually alone, or, more often, in consultation with colleagues.

When a curriculum project is developed and published, and he comes to know about it in some way, he will immediately form some impression of it from the nature of the source of information. This may come to him as publicity material from the curriculum development project itself or the publishers, or be mediated through one or more of the agencies shown in Figure 15.1. If the information arrives in the latter way it is rarely presented in a neutral context and may be associated with some added pressure, affecting its use.

If the project assumes any significance for the teacher he will eventually arrive at some conclusions about his use of it. The model proposed here is one of the teacher matching his perception of the project with his "world" and is derived from teachers' responses when they were asked about projects and the science curriculum in their schools.

The matching process for the teacher may be part conscious, part intuitive and may, for some, be a "Gestalt"-type activity, for others, a series of carefully argued steps, occurring in any order. For purposes of presentation and discussion the process is analysed into the four parts shown in Figure 17.3. The dimensions DISSATISFACTION, ACCEPTABILITY, RELEVANCE and FEASIBILITY arise from the four matching processes. The first describes an internal state of the teacher, while the remaining three indicate the teacher's perception of the state of the project in relation to himself or his situation. Each dimension presents a continuum from low to high and the teacher's matched position on the dimension can arise from his answer to the appropriate question in Table 17.1, (but this does not require that the teacher consciously poses each question

Fig. 17.3 A model of the processes of teacher decision-making with respect to a curriculum development project.


DISSATISFACTION
Low
High
Md
Matching practice and expectation
RESOURCES, ORGANIZATION
TEACHER: (self-image, personal characteristics, relationships with colleagues)
CURRICULUM DEVELOPMENT PROJECT (CDP) (perceived)
SOCIETY, PUPILS
Mf
Matching resources and organization with CDP
Ma
Matching philosophy, teaching style, etc. with CDP
Mr
Matching perceived pupil needs and CDP
Low
High
FEASIBILITY
Low
High
ACCEPTABILITY
Low
High
RELEVANCE

in the matching process).

Table 17.1 Dimensions in the matching process and the questions from which they may be derived

| Question | Dimension 1 |
|---|---|
| Do I need it? (Am I satisfied?) | DISSATISFACTION |
| Do I like it? | ACCEPTABILITY |
| Does it fit my pupils? | RELEVANCE |
| Does it fit my situation? | FEASIBILITY |

It is suggested that if the matched position is high on each dimension then the teacher is likely to use the curriculum project. If there is a low on any dimension this may block or modify use of the project.

One of the most significant matchings is that of practice and expectation. It can be postulated that teachers do not change because, in general, they are satisfied with their current practices. They have achieved some kind of equilibrium in their responses to pressures (stimuli and constraints) that reduces tension for them. Decision-making theory (Edwards and Tversky 1967) suggests that choices are made to increase probable gain or to reduce a probable loss. In the complex teaching-learning situation the gain corresponds to decreased tension and the loss to increased tension.[2]

If matching of practice and expectation results in low DISSATISFACTION a teacher is unlikely to change, even if a relevant acceptable and feasible project appears. It is possible, however, that the presence of a project may create dissatisfaction (hence it is shown as feeding into the Ma process) either by presenting an image of improved practice, or by its association with a consensus of approval within the science community.

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1. These dimensions were identified in discussions, at the Centre for Science Education, with Robert Nicodemus and Mary Waring. Nicodemus (1973) uses them to discuss an innovation process leading to radical or orthodox innovations.
2. It is even possible to suggest from McLeish (1969) that teachers modified their philosophical stance (expectation) when faced with a school situation in which different assumptions prevailed. This is also a tension-reducing ploy and fits the matching model.

There was indication in the case-studies that some teachers, with perhaps little inclination to change, seized upon some mismatch in another dimension to justify their not changing when faced with alternative practice receiving status support. It appeared to be more acceptable to plead limiting circumstances than to admit to being satisfied with existing practice.

Support for dimensions from other sources

The questionnaire enquiry into the outcomes of science education (discussed in Chapter 16) indicates how the ACCEPTABILITY of a project may affect its use: there was a greater degree of matching between the physicists' views of the importance of stated outcomes of science education and the importance they saw given to these in the Nuffield Physics Project (higher percentage use) than there was for biologists and the Biology Project (lower percentage use).

The importance of RELEVANCE and FEASIBILITY, and their legitimising function, is shown by the many teachers assuming the mis-match stances in the perception studies.[1]

Other studies appear to support the existence of these dimensions Taylor (1970) reports that pupil needs, interests and abilities (RELEVANCE) contributed 44% of principles used by teachers in planning courses.[2] Resources, time-table arrangements (FEASIBILITY) and the interests of teachers (ACCEPTABILITY) contributed nearly equally to a further 25%. In a rating of 15 internal issues taken into account in planning, the first four places included abilities of pupils (RELEVANCE), aims of the course (ACCEPTABILITY), subject matter to be employed and external examinations. Of 11 external issues, aims of the subject and personal needs of pupils again emerged as most important. The predominant reasons given for deciding that a plan needed revision was the discontent shown by pupils (55%), followed by teachers' comments (33%) and comparison with other schools or departments (23%) - all indicating DISSATISFACTION.

The application of the matching model to case-study data[3]

It is possible to apply the matching model to the situation in each of the case-study schools, but, for brevity, a few instances, relating to different curriculum projects, have been selected for discussion

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1. See Chapter 16
2. A two year study, completed in 1969, involving teachers of English, Geography and Science in Secondary schools containing children of average and below average ability in two LEA areas.
3. See Appendix S(iv)"Decision-making" for data used in these discussions.

to demonstrate the power and limitations of the model. As will be seen, the matching may be carried out against a background of variable familiarity with a project and may lead to a variety of outcomes.

Schools Council Integrated Science Project (SCISP)

At the time of the interviews in schools the materials of SCISP were just becoming available for the dissemination stage of its development. The project was at a disadvantage, as it were, in each part of the matching process: the common expectation in schools was that the more able pupils followed specialist science courses (this was related both to the pupils' perceived needs and to the specialist science teachers skills) it was, for most teachers, neither RELEVANT nor ACCEPTABLE, though some approved of the greater emphasis in it of "social" factors; the organisation of school science into specialist departments and the earlier allocation, in a considerable number of schools, of special funds for Nuffield Science courses, made further LEA support unlikely and reduced FEASIBILITY. Because of its "mismatch" the communication signals from it were weakly received and generally ignored.

In school De, however, the head of science had heard about SCISP on two previous occasions, but it did not assume significance for him until the LEA approached him, offering financial support if the school took part in the dissemination phase of the project. Here was a two-fold pressure: the increased resources and the status and recognition of a trial school (he had experienced both in the Nuffield Chemistry trials in a previous school). This disturbed his state of satisfaction (Md increased) and he and his colleagues went to considerable lengths to find out more about the project. They reported being favourably impressed by it (high Ma).

However, the situation in the science department was changing as the result of secondary reorganisation. It had to accommodate extra pupils of lower, but unknown (to the school) ability into Year 3, which was the year into which SCISP would have to be introduced. The project's materials were not developed for the whole ability range, and their interpretation of the social needs of the new Year 3 pupils made the science staff reluctant to stream them on entry. The project thus had limited relevance (Mr), although it was feasible(Mf) to the extent that financial support was available and a member of staff was willing to organise the course. They were prepared to modify the materials but found that some of the later parts of the course were not then available (low Mf). So, in the event, the head of Science, in consultation with his colleagues, decided "to shelve" SCISP and to turn to Nuffield Secondary Science. Here the matching had been carried out with a very high familiarity with the project and had led to its rejection.

School Ac had recently expanded and restructured its organisation. This had resulted in the appointment of a new head of the science and mathematics faculty and new heads of biology and physical science. A unique opportunity arose to create new practice (Md). The curriculum committee had mooted a "foundation course" in science for Year 4 and an integrated course appeared to be relevant (Mr). The teachers concerned had read the available SCISP materials and had attended a dissemination conference. The "philosophy" and "style" of all three senior teachers matched that of SCISP (Ma) and no great distances separated the laboratories (Mf). They had, perhaps, not yet experienced parental pressures for pupils to gain [illegible] level passes in the separate sciences, but the deputy head-master was aware of them(Mr depressed). The agreed use of the course was delayed by several factors: illness of an assistant teacher, requiring the head of science to take over his teaching load, the non-availability of Year 4 materials of SCISP and the head of science's desire to assess his pupils' range of abilities. The first two can be related to the availability of resources (Mf) and the last to need for more data to perform Mr.

The matching was carried out with high familiarity with the project and had led to delayed use.

The head of science in School Ce was dissatisfied with the way the energies of his department were fragmented over several unconnected courses and he was concerned by the lack of support offered to probationary teachers in this set-up (high Md). The headmaster had recently cut the time available for science in Year 4 and 5, which created difficulties for separate science courses (low Mf for current courses).

The head of science had visited trial schools and attended a 3-day course to find out about SCISP. The social orientation of the project pleased him (Ma) and he saw it to be more relevant to the needs of his pupils (Mr). Financial support had been offered and time for departmental meetings included on the time-table (leading to high Mf for an integrated course). The local HMI and Warden of the Curriculum Development Centre approved of SCISP (Md).

The resulting high position on each matching dimension led to the intended use of SCISP.

Nuffield Secondary Science

The science in School Aa had developed from the use of the Nuffield O level science courses in individualised learning programmes. The decision to change the Year 3 course can be analysed into the four parts of the matching process and it eventually led to the use of Nuffield Secondary Science which did not initially fit the separate science structure (Mf). The grumbles (high Md) voiced by the teachers of Year 3, were collected together by a senior member of the department. They mostly referred to the difficulities created for staff and pupils in operating the existing course (Mr low, for that course). Various alternatives were proposed and matched to organisation and teacher skills (Mf). The chosen solution (one teacher working across two sciences) was put into practice and proved so successful (Md low) that a full integration of the sciences was possible. The materials of Nuffield Secondary Science fitted this structure, giving high scores on Mf and Mr. For several teachers who were familiar with the project Ma was high and they drew upon the materials in designing their own parts of the course.

The pupils who chose to study only one science in School Ab followed an environmental science course. They were not intending to specialize in science and were usually the less able pupils academically. Nuffield Secondary Science appeared to satisfy their needs (Mr) and the school organisation (Mf). The teacher organising the work had studied a Natural Science course in his initial training as a mature student. He strongly approved of the Secondary Science materials (Ma) and possessed the skills to use them (Mf). Here full use of materials developed from a high familiarity with them.

In smaller comprehensive schools, particularly in LEA(B), the matching, Mr, involved a conflict of pressures. There was an assumption that the more able pupils needed specialist science qualifications, but that integrated courses were more suitable for the less able. However, there was a reluctance to label pupils by ability too early - sometimes not until examination entries were due - so that the pupils were frequently taught in mixed or parallel groups, with the course needs of the abler pupils predominating. This effectively blocked the use of Nuffield Secondary Science and few teachers were familiar with it. What amounted to a low outcome in matching, Mf, was quoted in School Ah as a reason for not using Nuffield Secondary Science, when C.S.E. groups in competition with O level groups for limited laboratory accommodation, had to work in ordinary classroom.

Nuffield O level Projects

The pupils need of a qualification, having chosen to study a science, was one of the most effective pressures influencing decision-making. The teachers who perceived that a larger proportion of their pupils would gain a pass at G.C.E. O level using a more conventional course and examination were less likely to choose the Nuffield course (Mr). This appeared to be particularly true of the Biology course; a larger proportion of girls than boys studied biology and some teachers assumed that girls experienced more problems than did boys with "the Nuffield approach".

In School Cb the acting head of science had come to teaching as an untrained graduate, after some years in industry and others at home with the family, to find a course very like her own school course, "limited and very traditional". The high Md outcome of her matching of practice and expectation sent her on Nuffield Biology courses. She liked the materials (Ma) and selected investigations to supplement her courses, judging that the girls" ability prevented the use of the full course (Mr).

The biologist in School Ae was highly dissatisfied with "traditional" biology and had become a biologist "in spite of my school biology", (high Md). He had been involved in development trials and had no doubts about the superior experience, for teacher and pupil, offered by the Nuffield Biology course (high Ma and Mr) and entered all of his O level groups for the Nuffield examination. This school had received grants for several years to establish the Nuffield O and A level courses in biology and it was the headmaster who expressed doubts about the survival of the projects in the school if they continued to make heavy demands on capitation (Mf).

In another trial school, however, (School Ad) the head of biology (for whom the Ma level for Nuffield Biology remained high) had decided to re-introduce the more "traditional" course and examination in parallel with the Nuffield course and to allow the pupils to choose which classes they would join. This followed several years of disappointing examination results (Md). In 1972/3 two thirds (mostly girls) of the "biology" pupils chose the more traditional course.

Other large schools (Ag and Ah) consciously selected out "brighter" pupils to follow the Nuffield course while other O level groups followed a more traditional course. West (1974) showed that this was so also in chemistry in some of the large London comprehensive schools. It appears, therefore, that one of the unintended consequences of the Nuffield O level projects has been to increase the number of classifications of science groups in schools to four: Nuffield O, "Trad." O, C.S.E. and "Non-exam."

## Nuffield Combined Science

The head of science in School Bd had become dissatisfied (Md) with his existing general science course for the 11-13 age range. A new colleague directed his attention to the Combined Science materials, which were put into limited use with a small grant from the LEA (moderate Mf).

The outcome was not entirely satisfactory as assessment expectations had not changed with the change in style of the course, possibly because the head of science's familiarity with the project was not high.

The new purpose-built comprehensive School Ca used Combined Science. Its objective fitted those of the school (Ma and Mr). The time-table initially allowed only four periods a week for science, presenting problems for the use of the three separate science (Mf low for these, but high for Combined Science).

For several other schools in LEA(C) the matching, Md, was performed by the science inspection. The report from this recommended the use of Combined Science, creating pressure on both schools and LEA. The LEA provided financial support (Mf), but the responses in the schools varied. In School Cd the head of science preferred the teaching to be organised in the separate sciences,but the headmaster had added his support for an integrated course to the advice of the inspectorate. The staff had decided to design their own course (the matching, Ma, for Combined Science possibly gave too low a value for them). For the head of science in School Cc Ma was high (as a Scot she was used to integrated courses for the early years of secondary school science, the inspectorate carried authority for her and she had been associated, in Scotland, with Nuffield Biology trials). In School Ce a Combined Science course was implemented, although Ma was not high for all teachers (and low for the technician), The separation of laboratories caused problems, reducing the Mf score, but time for departmental meetings was allowed, making an integrated course more feasible.

## Limitation of the matching model

The discussion in the last section has shown how the matching process model may be applied to decisions taken in schools by individual teachers, and by heads of departments interacting with colleagues (who may come to be regarded, in the act of decision-making, as resources that limit or facilitate a course of action).

The model is limited in that it does not allow the level at which the the matching process is performed to be displayed, nor can it be used to predict the outcome of the matching process.

Except when a decision to use a project was taken under some form of perceived duress (recommendation from Inspection, or a proffered grant), low familiarity was usually associated, as might be expected, with the non-use of a project. This might arise by default (as when teachers were ignorant of the existence of a project), but also if the initial, received image of the project, on superficial matching, resulted in low RELEVANCE. High familiarity with a project was associated with a range of use/non-use behaviour, usually following extensive matching activities.

A dimension has been proposed for each matching, but no scale developed; even if numerical scores were allocated it is doubtful whether a predicted outcome would be possible. The four dimensions are unlikely to be equivalent in importance, or to assume the same significance for all teachers.

A high level of matching for ACCEPTABILITY was important for the use of a project, but, as is shown by the biologist in School Ad, the matching to perceived pupil needs was over-riding. The effect of matching to resources was variable: the limited accommodation in School Be might have led to little class practical work being attempted. Instead, it was regarded as a challenge. The head of science had matched his expectation to the preferred style of his colleagues (separate sciences) leading to satisfaction with practice (and high Ma) and then made great demands on their enthusiasm and commitment.

## Teacher characteristics

Much depended on the individual teacher's personal characteristics. In the first stage reporting of the case-study data[1] it was suggested that five characteristics influenced decisions made in response to curriculum development projects.

They were "exposure to communication", "openness to change", "independence", "initiative" and "leadership".

### Exposure to communication

The number and variety of teachers' professional communication channels contributed to their sensitivity to stimuli from various sources. Those with a number of different contacts were often those familiar with projects, who had sought out further information about them and could discuss them at length. The variety as well as total number of communication channels was significant: some teachers employed only particular channels carrying messages reinforcing their existing attitudes:[2] One teacher,

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1. See Appendix S (iv), p335
2. It is significant here that the journal and bulletin of the ASE carried articles and correspondence expressing a whole range of views on curriculum projects.

active in GCE examining and in the A.M.A. (representing the latter at Schools Council) appeared to find reinforcement in these contacts for his efforts to prevent change.

Carlson (1964), examining social structure variables of school superintendents in Pennsylvania demonstrated that rate of adoption of modern mathematics was related to the pattern of interaction and communication activities involving the superintendents.

A section enquiring into "other commitments" was built into the interview communication schedule, because it was suspected that more extensive home commitments, often assumed by women, might be associated with fewer communication activities. No such pattern emerged with the few women teachers interviewed, but for several teachers, men and women, those most actively involved with curriculum projects were those reporting the heaviest commitments out of school or "extra-curricular" activities.

### Openness to change

The teachers interviewed appeared to vary considerably in their attitudes to change, ranging from those who were prepared to consider any new idea, to others for whom change appeared to be a threat of some kind. It is possible that a person's attitude to change is a fundamental part of his self-image and is as critical to his behaviour as the introvert-extrovert or other personality dimension.

Measures of innovativeness have related, in most studies, to adoption behaviour (Rogers, 1972). "Innovators" and "early adopters", in pioneering or readily accepting a change, would score highly in "openness to change", but such measures have no value in predicting or explaining adoptive behaviour. Emery and Oeser(1958) in a study of the psychological determinants of changes in farming techniques in Victoria, Australia, have explored dimensions such as urbanisation, situational supports and conceptual skills of farmers and shown them to control exposure to communication and the use of new farming practices. No similar studies appear to have been carried out for teachers. It might be worth examining how a teacher's background, past experience and training[1] cluster with use of new methods and to explore the possibility of deriving an attitude scale towards change.

### Independence and initiative

These characteristics were suggested because it was observed that several teachers maintained a course of action that appeared to run counter to the prevailing climate of opinion in their immediate situation. For some this resulted in not changing when others did, while others changed their courses, taking the initiative and acting independently. This was apparent not so much within separate science departments (although it could occur there) as between them and may display, not separate characteristics, but the result of different levels of communication. For the former group low communication activities may provide an insulation from the climate of opinion in the wider community, while the teachers in the latter group may be more influenced by their membership of specialist science groups beyond the school than by the community within it.

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[1] The CDRP questionnaire survey suggests that teachers holding a teachers' certificate have a higher reported familiarity with curriculum projects than do teachers with a degree even if this was followed by training.

## Leadership

One of the most effective factors in the establishing and implementing of a new course was the leadership behaviour of individual teachers. This is an elusive characteristic, difficult to define, but is expressed in behaviour that results in others voluntarily choosing to co-operate or follow a similar course of action to that taken by the "leader". The head of science in School Be displayed highly effective leadership qualities in his department, but not within the county as a whole. This may have depended on his self-image or his particular style of relating to other people. The teacher, from whose actions the County Science Teachers' Association was founded, exercised leadership within a much wider context, seeing himself, perhaps, as a more public figure.

In LEA (D) the wider use of the Nuffield O level Chemistry Project could be traced back to the leadership of one teacher. In the open situation of School Aa the head of physical science assumed leadership in achieving a solution of the problem of the Year 3 curriculum. The absence of leadership in School Bj led to massive disillusionments and a sense of isolation.

## Conclusion

Curricular decision-making within the LEA and schools has most commonly taken place, not as the result of an overall strategy directed towards identified goals, but as a piece-meal response to pressures.

The process by which a decision is made at the school level is one of matching a course to the perceived needs of pupils, the resources available and the teacher's own aims, objectives and preferred style of teaching. Changes occur when the matching of expectation and practice leads to dissatisfaction.

Personal characteristics of teachers, such as openness to change, exposure to communication (which may be dependent on the former) and initiative and leadership qualities are powerful modifying factors on the course of action taken after the matching process has been carried out. We know little about the origin of these characteristics or their measurement in the field of education.

## CHAPTER 18

## CONCLUSIONS

The intention of the Curriculum Diffusion Research Project, of which this study forms a part, was to examine the diffusion of new science curricula from development team to the schools.

### 1. The complexity of the phenomenon studied

A large number of variables emerged as potentially significant:

(i) in the nature of the change to be introduced - the main study included enquiry about curriculum development project to head teacher and science projects to science teachers (although in this study the range limited to six projects).

(ii) in the level of use to be conceptualized as "adoption" - it was far from clear whether the change intended was to be the full use of a package, or a behaviour change for which materials merely provided one possible pattern. Only the O and A level projects carried independent measures of their full use.

(iii) in the educational system maintaining the schools - LEAs varied greatly in size, in resources of finance and manpower and in the types of community they served.

(iv) in the fluid and changing school systems - in moves made to reorganize secondary schooling along comprehensive lines within existing resources the resulting schools displayed a multiplicity of backgrounds, traditions, expectations and objectives.

(v) in the identity and experience of teachers - although some teachers in the study were involved in teaching "science", most were teachers of biology, chemistry or physics, but within each group a range of attitudes to science education existed.

### 2. Methodological problems

The complexity of curriculum diffusion, the meagre nature of earlier work in the country, and the need to assemble data while they were yet available presented problems for the enquiry. Few assumptions could be made.

The multiplicity of factors, derived from discussion and pilot studies, potentially affecting use of projects creates difficulties for questionnaire survey design. The detailed questioning that might reflect the complexity of the field results in an over-long instrument, daunting for the respondent and difficult to analyse. Simplification of factors produces a questionnaire of more reasonable length, more readily handled in the computer, but with problems of interpretation. Discussions between the research team and others planning diffusion and implementation studies suggest that this is a recurrent problem, not initially apparent to those guiding research. A further, little-realised factor is the length of time that must be allowed in practice for computer analysis within most institutions.

In a relatively unexplored field the case-study has potentially several roles to play. It can be used in introductory studies to identify factors appearing to influence events and to generate hypotheses that may be tested in more general surveys; it can enquire into processes in a way not open to questionnaire surveys. But problems are inherent in the use of case-studies in a project of limited life enquiring in a complex new field:

(i) time may not be available for the case-study to be used sequentially;

(ii) if case-studies are used in parallel with questionnaire studies time, over and above that required to analyse each separate study, must be allowed to integrate the findings;

(iii) no criteria are available to select the significant instance for study, so that the researcher is under pressure to include many instances in an attempt to improve the validity of findings. This may lead to a superficial examination of each case, with a consequent loss of information.

There appears to be a need for an accumulation of studies of the way individual schools and/or teachers respond to curriculum innovation.

In addition there are problems still to be solved in the case study as a tool in curriculum research, both in diffusion and in the evaluation of implementation. MacDonald and Walker (1975) have initiated discussion of the latter, but it is questionable whether the code of practice and methods of reporting acceptable to the form of "action research" appropriate to evaluation studies are relevant to a more objective research study in diffusion.

The case studies undertaken in this enquiry have emphasised that the experience and judgement of the interviewer are important factors operating in the creation of data. Walker (1974) suggests that a rigorously developed procedure may eliminate variance arising from "intuition" and appears to assume that to start from relative ignorance of a system may be an advantage for a case-study worker. Elsewhere (Wall 1968) it is emphasised that an intimate knowledge of the education system and process is an important qualification for the researcher. What is not clear is how this experience influences the acceptability of research findings.

3. The appropriateness of models

(i) The S-shaped adoption curve

One of the most frequently used models in early diffusion studies has been the S-shaped curve for the adoption of an innovation. From this study it is suggested that the communication of the curriculum change embodied in a curriculum project (and reflected in the sale of materials and the provision of in-service courses) reaches a peak very soon after the publication of materials, i.e. no slow build-up to a maximum is displayed. However, where it has been possible to study the use over time (examination entries) an approximation to an S-shaped curve appears to be obtained. But it is questioned here whether the use of such curves to identify categories of adopting units has validity in the complex decision-making context revealed in this study.

(ii) Stages in the "innovation-decision" process

The stages identified by Rogers are, briefly, knowledge, persuasion, decision and confirmation. As elements it is possible to detect the presence of these in the decisions made at the teacher/school level, especially where these have resulted in the use of curriculum projects: the knowledge of a curriculum project enters the local situation, the attention given to it (or the visibility of the knowledge) will be influenced by the degree of dissatisfaction extant in particular situations, and the degree of match between the organisational structures in the school and those required by the project. The persuasion function is provided partly by the level of expectation or norms established locally and partly by the teacher's own readiness to be involved in persuasion activities (talking with other teachers, buying materials, attending courses). It is suggested that a decision is reached by the matching of the demands of the project with his own world on a tension-reducing basis, so that the teacher continues to monitor the effects of putting the decision into practice. If a further tension is created (increased pupil dissatisfaction, heavier work-load) the teacher may modify his decision.

However, for many teachers assuming a non-use stance the knowledge and persuasion functions appear to be slight, a decision is made, almost immediately, not to use a project and most evident is the confirmation stage, which appears as a rationalisation of the decision and a justification for it, usually in terms of a mismatch between the project and the elements perceived in the local situation.

(iii) Levels of analysis

The findings within all sections of this study confirm the relevance of a hierarchical framework (such as proposed by Goodlad or Hoyle) for curriculum analysis, in spite of the insistence within Schools Council and elsewhere, on the "freedom of the teacher" in curriculum matters. There appears to be four levels of analysis:

central government decisions, usually, nut not always, common for all local areas;

the local education authority, together with other local institutions with relevance for education;

the school: organisation and personnel;

the individual teacher.

(iv) Strategies for change

Of the general strategies for change discussed in Chapter 1 those that approximate most closely to the processes identified in this study are the social interaction and power-coercive models. A few of the early enthusiasts (the revolutionaries) may have been convinced by the rational claims of materials developed through trials, but those interviewed more often referred to an affective response (of excitement, for example, when introduced to the early Nuffield courses).

Some instances of the use of the problem-solving model were also recorded (the introduction of SCISP after discussions with an HMI, or of Secondary Science following a process of consultation initiated by a head of science), but the influence of leadership referred to below indicates a dependence on social interaction, while central government decisions (raising the school-leaving age and comprehensive reorganisation) have curricular consequences that can only be described as power-coercive.

The implementation of Havelock's regional "Resource-Linking Agencies" on any formal basis is unlikely to occur and is possibly not even desirable. It has been argued[1] that the open nature of the present system allows the emergence of leadership from a multiplicity of persons and institutions; it throws up the need for a coordinating role to monitor resources of all kinds (including that of persons) and to attempt to make good deficiencies. The local authority advisers appear to be ideally situated within the formal structures of the education system to fill this role, but it is a difficult role, almost by definition denying the right to exercise leadership, and the tendency of the enlarged LEA to increase the administrative load on its advisers would reduce their effectiveness in the role.

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[1] See Chapter 15.

4. Significant findings[1]

(i) The differential use of projects for boys and girls placed, as it is, within the framework of the unequal choosing by them of science options in the curriculum, suggests the operation of sex roles in science and the heavy dependence of decisions by both pupils and teachers on a narrowly perceived vocational role for science education.

(ii) In each of the areas visited for the case-study programme communication networks involving science teachers were detected. These occurred most often in separate structures for biology, chemistry and physics teachers and were institutionalized by public examination activities, membership of teachers' centres, etc.[2] Each area had evolved a pattern specific to its own unique interaction of geographical and organisational factors - an interaction moulded and sometimes promoted by key persons exercising leadership. The structures were not static, but changed as the organisation of schooling and personnel changed, and, as suggested above, it was through their participation in these activities that teachers contributed to the establishing of local norms and were influenced by them.

It is suggested here that attempts to change science education through curriculum projects have been most effective at the local level where high communication activity is practised and where leadership, specific to a particular project or way of working, has emerged.

(iii) The communication structures referred to in (ii) form part of the local communication-support system[3] within which schools operate. While the relationship between communication-support and the use of projects has been inadequately tested in this study, the concept of a communication-support system, partially determining the level of teacher response to curriculum change, remains a powerful concept that may warrant further exploration.

---

[1] The use of the term "significant" here implies no statistical relationship. In the judgement of the writer the relationships discussed appear significant and worth examining more closely.

[2] See Chapter 15.

[3] See Table 14.5

(iv) The concept of curricular decision-making as a response to pressures, carried out as a matching process along the four dimensions of dissatisfaction, acceptability, relevance and feasibility, may be used to develop strategies for change. When a change is initiated outside the local system it will most likely be implemented if it builds on, or creates, dissatisfaction with the status quo and sets out to alter local norms in the direction of the desired behaviour to increase the acceptability of the change. The change will be facilitated if the form in which it is expressed is flexible enough to be adaptive to the local situation (i.e. it is seen as relevant) and if essential resources are available to ensure feasibility. Problems will occur in implementing the change if it requires teachers to assume a changed identity or if it appears to be in conflict with the vocational aims of science education.

In the discussion above "the change" has been personalized in order to emphasise the importance, identified in this study, of personal sponsorship as a vehicle for carrying through a change.[1] The leadership of key persons has emerged as an important factor in establishing norms of behaviour in science education at all levels: nationally[2], locally[3] and in the schools.[4]

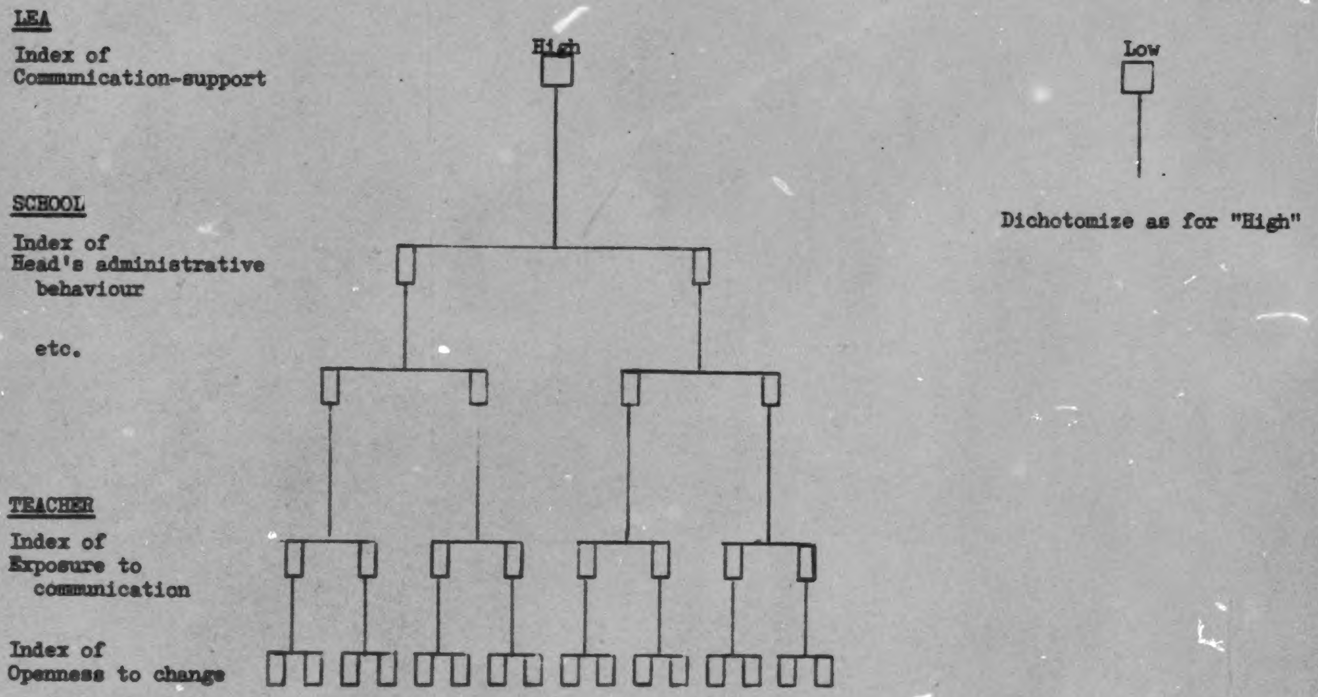
(v) When the matching processes are carried out by the teacher it is apparent that the outcomes of matching and the decision reached vis-a-vis a curriculum project is dependent on the teacher's own attitudes and his perception of the project. In Chapter 17 it was argued that important characteristics, in this connection, are exposure to communication, openness to change, independence and initiative and leadership and that the relationships between these and the curricular behaviour of teachers should be explored.

Finally, if it is of interest to chart the antecedents of individual decisions in the curriculum it is suggested that it might be attempted as shown in Figure 18.1. This would require identifying variables at the level of LEA, schools and the teacher that relate to changed curricular

---

1. The mode of influence identified here is in conflict with the neutral role of change agent defined by Havelock (1972). Bennis, Benne and Chin (1969) on the other hand suggest that in normative-re-educative strategies the chief concern of the change agent is to take into account the attitudes, values and opinions of the client and by bringing these, along with his own, into the open work through value-conflicts to changed behaviour.
2. See Waring (1975)
3. See Chapter 15.
4. See Chapter 17.

Fig. 18.1 Typology of teachers involved in curricular decision-making


LEA
Index of
Communication-support
High
Low
Dichotomize as for "High"
SCHOOL
Index of
Head's administrative
behaviour
etc.
TEACHER
Index of
Exposure to
communication
Index of
Openness to change

practices creating indices from them that dichotomize into high and low values, and placing individuals within the cells thus formed.[1]

This study suggests that an index of communication support might be derived at the local level, while for the teacher measures such as exposure to communication and "openness to change" appear significant. Few data have been assembled at the school level for this study[2] but, for example, Halpin (1966) has derived an index of Administrative Behaviour which may have relevance for the head teacher and curriculum development.

Although this study has concentrated on the use of curriculum development projects as the "change" conceived in school science education, it is recognised that their apparent use may result in no change occurring in practice - if the earlier way of working was similar to that embodied in the project used, or if in its use materials and objectives are modified to suit current practice.

In the event that the desired change is not narrowly conceived as the use of a curriculum project but is the adoption of a broader, innovative approach to science education, requiring the identification of problems and the search for possible solutions, then much of the foregoing analysis remains relevant.

---

1. Emery and Oeser (1958) use a similar procedure to create a typology of Australian sheep farmers related to adoption of innovation.

2. Benson (1973), after discussion with the present writer, has used a typology based on the above to discuss the relative successes of two schools in implementing mixed ability teaching.

# APPENDICES

1

**APPENDIX P.A**

P.01

For office use

- - - - - - 1

**CURRICULUM DIFFUSION RESEARCH PROJECT,**
Chelsea College, Bridges Place, London, S.W.6.

*A Study of the Usefulness of Curriculum Development Projects*

## HEAD TEACHER QUESTIONNAIRE

### Section 1. School information *(please circle correct answer)*

WHICH ONE OF THE FOLLOWING BEST DESCRIBES THE ABILITY RANGE OF PUPILS IN YOUR SCHOOL?

| | | |
|---|---|---|
| grammar or technical grammar | 1 | 7 |
| secondary modern | 2 | |
| comprehensive with fully representative ability range for area | 3 | |
| comprehensive but some (less than 10%) able pupils from area going to a grammar school | 4 | |
| comprehensive but many (10% or over) of able pupils from area going to a grammar school | 5 | |
| 6th form college | 6 | |

IF YOUR SCHOOL IS AT PRESENT UNDERGOING RE-ORGANIZATION (OR DID LAST YEAR OR WILL WITHIN THE NEXT 3 YEARS) PLEASE INDICATE THE TYPE OF CHANGE –

| | | |
|---|---|---|
| no change | 0 | 8 |
| secondary modern to comprehensive | 1 | |
| grammar to comprehensive | 2 | |
| grammar and secondary modern to comprehensive | 3 | |
| other (please specify)<br>.................................................................................................................. | 4 | |

WHAT IS THE AGE RANGE OF YOUR PUPILS?

| | | | | |
|---|---|---|---|---|
| 11 to 13 | 1 | 13 to 16 | 5 | 9 |
| 11 to 14 | 2 | 13 to 18 | 6 | |
| 11 to 16 | 3 | 16 to 18 | 7 | |
| 11 to 18 | 4 | other (please specify)<br>.......................................... | 8 | |

WHAT IS THE SEX OF PUPILS?

| | | |
|---|---|---|
| Boys | 1 | 10 |
| Girls | 2 | |
| Mixed | 3 | |

HOW MANY PUPILS ARE THERE IN YOUR SCHOOL?
(Please write number in box) ... ... ... ... ... ☐ 11–14

### Section 2. Individual information

HOW MANY YEARS HAVE YOU BEEN IN YOUR PRESENT SCHOOL AS A HEAD TEACHER? ... ... ... ☐ 15–16

HOW MANY YEARS IN ALL HAVE YOU BEEN A HEAD TEACHER? ☐ 17–18

IN WHAT SUBJECT AREA DID YOU OBTAIN YOUR QUALIFICATION AT COLLEGE OR UNIVERSITY?

| | | |
|---|---|---|
| humanities | 1 | 19 |
| social sciences | 2 | |
| science/technology | 3 | |
| mathematics | 4 | |
| other (please specify)<br>.......................................... | 5 | |

DO YOU PRESENTLY TEACH IN YOUR SUBJECT AREA?

| | | |
|---|---|---|
| Yes | 1 | 20 |
| No | 2 | |

## Section 3. Project influence and familiarity

Please use the following code to indicate in the first column (A) your impression of the influence of each curriculum project on the teaching within your school by writing one of the five numbers in each box.

LEAVE BOX BLANK IF YOU HAVE NO OPINION OR DO NOT KNOW ABOUT THE PROJECT.

*In my opinion the project materials have –*

5 – considerable desirable effects
4 – some desirable effects
3 – no effects
2 – some undesirable effects
1 – considerable undesirable effects

Please tick ✓ in the columns (B-G) after each curriculum project the statements which are correct in your case.

LEAVE SPACE BLANK IF YOU DO NOT KNOW.

*I am aware of the following aspects of the project –*

| | (A) rating of influence | (B) the projects existence | (C) age and ability range | (D) main object-ives | (E) main teaching methods | (F) materials produced or planned | (G) approx cost of adoption | *For office use* |
|---|---|---|---|---|---|---|---|---|
| *Projects supported by Schools Council* | | | | | | | | |
| Environmental Studies | ☐ | | | | | | | 21–27 |
| General Studies Project | ☐ | | | | | | | 28–34 |
| Humanities Curriculum Project | ☐ | | | | | | | 35–41 |
| Integrated Science (SCISP) | ☐ | | | | | | | 42–48 |
| Keele Integrated Studies | ☐ | | | | | | | 49–55 |
| Loughborough Engineering Science | ☐ | | | | | | | 56–62 |
| Mathematics for the Majority | ☐ | | | | | | | 63–69 |
| Mathematics for the Majority Continuation Project | ☐ | | | | | | | 70–76 |
| | | | | | | | | – – – – – 2 |
| Midlands Mathematics Experiment | ☐ | | | | | | | 7–13 |
| Moral Education 13–16 | ☐ | | | | | | | 14–20 |
| North-West Regional Curriculum Development Project | ☐ | | | | | | | 21–27 |
| Project Environment | ☐ | | | | | | | 28–34 |
| Project Technology | ☐ | | | | | | | 35–41 |
| Science 5–13 | ☐ | | | | | | | 42–48 |
| *Nuffield Projects* | | | | | | | | |
| O-level Biology | ☐ | | | | | | | 49–55 |
| O-level Chemistry | ☐ | | | | | | | 56–62 |
| O-level Physics | ☐ | | | | | | | 63–69 |
| A-level Biological Science | ☐ | | | | | | | 70–76 |
| | | | | | | | | – – – – – 3 |
| A-level Chemistry | ☐ | | | | | | | 7–13 |
| A-level Physics | ☐ | | | | | | | 14–20 |
| A-level Physical Science | ☐ | | | | | | | 21–27 |
| Combined Science | ☐ | | | | | | | 28–34 |
| Secondary Science | ☐ | | | | | | | 35–41 |
| Nuffield Mathematics | ☐ | | | | | | | 42–48 |
| *Other* | | | | | | | | |
| Scottish Integrated Science | ☐ | | | | | | | 49–55 |

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*For office use*

**Section 4. Involvement in projects**

PLEASE NAME THOSE PROJECTS LISTED IN SECTION 3 ON FACING PAGE WHOSE MATERIALS ARE USED FULLY OR IN PART IN YOUR SCHOOL –

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

– –

– – 56–57

– – 58–59

– – 60–61

– – 62–63

– – 64–65

– – 66–67

– – 68–69

– – 70–71

– – 72–73

– – 74–75

– – 76–77

– – 78–79

– – – – – 4

IF YOUR SCHOOL HAS PARTICIPATED IN THE TRIALS OF ANY PROJECTS LISTED ON THE FACING PAGE, PLEASE NAME THE PROJECT(S) BELOW –

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

IN ADDITION TO THE PROJECTS LISTED ON THE FACING PAGE, WHAT OTHER PROJECTS (CURRICULUM OR RESEARCH), IN YOUR OPINION, INFLUENCE TEACHING IN YOUR SCHOOL? **Please comment below –**

..........................................................................................................................................

..........................................................................................................................................

..........................................................................................................................................

– – 7–8

– – 9–10

– – 11–12

– – 13–14

– – 15–16

– – 17

– – 18–19

– – 20–21

– – 22–23

– – 24–25

– – 26–27

– – 28–29

– – 30–31

– – 32–33

– 34

**Section 5. Future influences**

IN YOUR OPINION, OF WHAT IMPORTANCE MAY THE FOLLOWING DEVELOPMENTS OR PROJECTS BE IN INFLUENCING FUTURE CHANGES IN THE CURRICULUM?

| *Please circle appropriate number* | considerable importance | some importance | little importance | no importance | |
|---|---|---|---|---|---|
| Educational priority area projects (EPA) | 4 | 3 | 2 | 1 | 35 |
| comprehensive reorganization | 4 | 3 | 2 | 1 | 36 |
| raising of the school leaving age | 4 | 3 | 2 | 1 | 37 |
| reorganization of LEA boundaries | 4 | 3 | 2 | 1 | 38 |
| reorganization of teacher education | 4 | 3 | 2 | 1 | 39 |
| others (please specify) | | | | | |
| .................................................................. | 4 | 3 | 2 | 1 | 40 |

– – 41–42

– – 43–44

– – 45–46

– – 47–48

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## Section 6. Usefulness of information sources

Please circle the appropriate number in the columns below to indicate the extent to which you find the following sources of information about curriculum development projects useful –

| | very useful | sometimes useful | rarely useful | never useful | For office use |
|---|---|---|---|---|---|
| *Impersonal sources* | | | | | |
| L.E.A. circulars | 4 | 3 | 2 | 1 | 49 |
| D.E.S. memoranda and circulars | 4 | 3 | 2 | 1 | 50 |
| information direct from curriculum development projects | 4 | 3 | 2 | 1 | 51 |
| information from publishers | 4 | 3 | 2 | 1 | 52 |
| information from supply catalogues | 4 | 3 | 2 | 1 | 53 |
| 'Times Educational Supplement' | 4 | 3 | 2 | 1 | 54 |
| Schools Council 'Dialogue' | 4 | 3 | 2 | 1 | 55 |
| Schools Council Project Profiles and Index | 4 | 3 | 2 | 1 | 56 |
| other Schools Council publications | 4 | 3 | 2 | 1 | 57 |
| specialist subject journals | 4 | 3 | 2 | 1 | 58 |
| other educational journals | 4 | 3 | 2 | 1 | 59 |
| BBC T.V. educational programmes | 4 | 3 | 2 | 1 | 60 |
| *Personal sources* (direct or in meetings) | | | | | |
| head of departments in your school | 4 | 3 | 2 | 1 | 61 |
| assistant teachers in your school | 4 | 3 | 2 | 1 | 62 |
| teachers from other schools | 4 | 3 | 2 | 1 | 63 |
| staff from schools participating in the trials of a curriculum project | 4 | 3 | 2 | 1 | 64 |
| head teachers | 4 | 3 | 2 | 1 | 65 |
| L.E.A. advisers/inspectors | 4 | 3 | 2 | 1 | 66 |
| Schools Council field officers | 4 | 3 | 2 | 1 | 67 |
| H.M.I.s | 4 | 3 | 2 | 1 | 68 |
| university lecturers | 4 | 3 | 2 | 1 | 69 |
| colleges of education lecturers | 4 | 3 | 2 | 1 | 70 |
| school governors | 4 | 3 | 2 | 1 | 71 |
| parents | 4 | 3 | 2 | 1 | 72 |

## Section 7. Ranking of information sources

Would you please rank up to four of all the sources listed in Section 6 in terms of relative usefulness. Take into consideration both impersonal and personal sources.

most useful .................................................................... 73–74

second most useful .................................................................... 75–76

third most useful .................................................................... 77–78

fourth most useful .................................................................... 79–80

_ _ _ _ _5

P.05

## Section 6. Facilitating and limiting factors relating to your own school

The following list is of factors that may facilitate or limit the taking up of curriculum project materials and ideas.

Please circle the one number after each factor to indicate the extent of influence in your school.

|  | strongly facilitate | moderately facilitate | no effect | moderately limit | strongly limit | For office use |
|---|---|---|---|---|---|---|
| qualifications of teaching staff | 5 | 4 | 3 | 2 | 1 | 7 |
| staff turnover | 5 | 4 | 3 | 2 | 1 | 8 |
| staff overworked | 5 | 4 | 3 | 2 | 1 | 9 |
| pastoral care of pupils | 5 | 4 | 3 | 2 | 1 | 10 |
| materials produced for a restricted ability range | 5 | 4 | 3 | 2 | 1 | 11 |
| university entry requirements | 5 | 4 | 3 | 2 | 1 | 12 |
| availability of CSE Mode 3 | 5 | 4 | 3 | 2 | 1 | 13 |
| provisions of special examinations relating to the project | 5 | 4 | 3 | 2 | 1 | 14 |
| availability of report on project evaluation | 5 | 4 | 3 | 2 | 1 | 15 |
| availability of money to launch projects | 5 | 4 | 3 | 2 | 1 | 16 |
| availability of money to maintain projects | 5 | 4 | 3 | 2 | 1 | 17 |
| adequate accommodation in school | 5 | 4 | 3 | 2 | 1 | 18 |
| use of school for student teaching practice | 5 | 4 | 3 | 2 | 1 | 19 |
| active teachers' centre in area | 5 | 4 | 3 | 2 | 1 | 20 |
| contacts between schools in the area | 5 | 4 | 3 | 2 | 1 | 21 |
| L.E.A. initiative in innovation | 5 | 4 | 3 | 2 | 1 | 22 |
| L.E.A. advisory service | 5 | 4 | 3 | 2 | 1 | 23 |
| school planning for secondary reorganization | 5 | 4 | 3 | 2 | 1 | 24 |
| influence of secondary reorganization on the school curricula | 5 | 4 | 3 | 2 | 1 | 25 |
| influence of secondary reorganization on communication with other schools | 5 | 4 | 3 | 2 | 1 | 26 |
| uncertainty about school reorganization | 5 | 4 | 3 | 2 | 1 | 27 |
| others (please specify) |  |  |  |  |  |  |
| ........................................ | 5 | 4 | 3 | 2 | 1 | 28 |

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## Section 9. Effects of curriculum projects

Some of the possible effects of curriculum research and development projects are listed below.

Please indicate your opinion of their significance by circling one number after each statement.

*On the whole the effects of curriculum development projects have been to –*

| | agree strongly | agree | un-decided | disagree | disagree strongly | For office use |
|---|---|---|---|---|---|---|
| improve the quality of pupils' school experience | 5 | 4 | 3 | 2 | 1 | 29 |
| support those teachers who are already attempting to bring about change in schools | 5 | 4 | 3 | 2 | 1 | 30 |
| over-emphasize the role of technical aids in teaching (e.g. programmed learning) | 5 | 4 | 3 | 2 | 1 | 31 |
| provide resources from which teachers may select | 5 | 4 | 3 | 2 | 1 | 32 |
| increase the burden of preparation for teachers | 5 | 4 | 3 | 2 | 1 | 33 |
| provide packages that can be fully adopted | 5 | 4 | 3 | 2 | 1 | 34 |
| promise more improvements than can reasonably be expected | 5 | 4 | 3 | 2 | 1 | 35 |
| introduce new methods of teaching into the schools | 5 | 4 | 3 | 2 | 1 | 36 |
| enable an atypical group to impose unrealistic standards for the rest of the schools' population | 5 | 4 | 3 | 2 | 1 | 37 |
| provide schemes for teaching based on the psychology of learning | 5 | 4 | 3 | 2 | 1 | 38 |
| promote dissatisfaction with what has been tested over time and shown to work | 5 | 4 | 3 | 2 | 1 | 39 |
| demonstrate how new subject matter may be introduced at school level | 5 | 4 | 3 | 2 | 1 | 40 |
| promote the use of behavioural objectives | 5 | 4 | 3 | 2 | 1 | 41 |
| widen the aims and objectives of teaching a subject | 5 | 4 | 3 | 2 | 1 | 42 |
| maintain specialist divisions between subjects | 5 | 4 | 3 | 2 | 1 | 43 |
| provide alternatives for school programmes | 5 | 4 | 3 | 2 | 1 | 44 |
| support classification of children into ability groups | 5 | 4 | 3 | 2 | 1 | 45 |
| influence changes in external examinations | 5 | 4 | 3 | 2 | 1 | 46 |
| appeal to "band-wagon" participation by teachers | 5 | 4 | 3 | 2 | 1 | 47 |
| influence the internal organization of schools (time-tabling, streaming, etc.) | 5 | 4 | 3 | 2 | 1 | 48 |
| provide a means of promoting personal status | 5 | 4 | 3 | 2 | 1 | 49 |
| discourage innovation because of the multiplicity of projects | 5 | 4 | 3 | 2 | 1 | 50 |
| encourage L.E.A.s to provide improved facilities | 5 | 4 | 3 | 2 | 1 | 51 |
| provide idealists with a platform | 5 | 4 | 3 | 2 | 1 | 52 |
| increase outside support for change in schools | 5 | 4 | 3 | 2 | 1 | 53 |
| create feelings of inadequacy in teachers | 5 | 4 | 3 | 2 | 1 | 54 |
| support the influence of schools on local government education policy | 5 | 4 | 3 | 2 | 1 | 55 |
| introduce uniformity into school programmes | 5 | 4 | 3 | 2 | 1 | 56 |
| support the influence of schools on national government education policy | 5 | 4 | 3 | 2 | 1 | 57 |

THANK YOU FOR YOUR CO-OPERATION

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**APPENDIX P.ii.**

*For office use*

**all replies are strictly confidential**

**CURRICULUM DIFFUSION RESEARCH PROJECT**
Centre for Science Education
Chelsea College, Bridges Place, S.W.6.

1 7

## TEACHER QUESTIONNAIRE

**Section 1. Information** *(for each item please select the number which best answers the question for you and enter in the box to the right)*

**WHAT IS YOUR APPOINTMENT?** .. .. .. .. .. .. ☐ 8

1 – head of science department
2 – head of biology, chemistry or physics
3 – assistant teacher
4 – other (please specify)
..........................................................

**WHAT WAS YOUR TRAINING?** .. .. .. .. .. .. ☐ 9

1 – teacher's certificate
2 – degree or degree equivalent
3 – degree + graduate certificate in education
4 – higher degree
5 – higher degree + graduate certificate in education
6 – other (please specify)
..........................................................

**WHAT IS THE MAIN SUBJECT YOU TEACH?** ___ 10

.............................................................................................. ___ 11

**PLEASE INDICATE HOW MANY PERIODS YOU TEACH IN A SPECIALIST SCIENCE SUBJECT (e.g. biology, chemistry or physics) TO THE FOLLOWING GROUPS DURING ONE WEEK –**

non-examination groups ___ 12–13
CSE groups ___ 14–15
O-level groups ___ 16–17
A-level groups ___ 18–19

**HOW MANY PERIODS DO YOU TEACH GENERAL, INTEGRATED OR COMBINED SCIENCE?** .. .. .. .. .. ___ 20–21

**HOW MANY PERIODS DO YOU TEACH IN SUBJECTS OTHER THAN SCIENCE?** ___ 22–23

**HOW MANY YEARS OF FULL-TIME TEACHING HAVE YOU COMPLETED?** ___ 24–25

**HOW MANY YEARS HAVE YOU COMPLETED IN YOUR PRESENT SCHOOL?** ___ 26–27

**IN HOW MANY SECONDARY SCHOOLS HAVE YOU PREVIOUSLY TAUGHT?** ___ 28–29

**HOW MANY YEARS HAVE YOU COMPLETED WITH YOUR PRESENT LEA?** ___ 30–31

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For office use

**Section 2. Curriculum Development Projects**

PLEASE INDICATE THE EXTENT TO WHICH YOU ARE

(a) . FAMILIAR WITH and

(b) USE THE MATERIALS OR IDEAS FROM CURRICULUM DEVELOPMENT PROJECTS.

**(a) FAMILIARITY**

1 – not familiar
2 – read about or heard of project
3 – read a few of the materials
4 – read most of the materials

**(b) USE (by yourself)**

1 – do not use
2 – using ideas from project but not the materials at present
3 – less than 1/3 of the materials used at present
4 – more than 1/3 but less than 2/3 of the materials used at present
5 – all or most of the materials used at present

| **Nuffield Projects** | **FAMILIARITY** | **USE** | |
|---|---|---|---|
| O-level Biology .. .. .. | ☐ | ☐ | 32–33 |
| O-level Chemistry .. .. .. | ☐ | ☐ | 34–35 |
| O-level Physics .. .. .. | ☐ | ☐ | 36–37 |
| A-level Biological Science .. .. | ☐ | ☐ | 38–39 |
| A-level Chemistry .. .. .. | ☐ | ☐ | 40–41 |
| A-level Physics .. .. .. | ☐ | ☐ | 42–43 |
| A-level Physical Science .. .. | ☐ | ☐ | 44–45 |
| Combined Science .. .. .. | ☐ | ☐ | 46–47 |
| Secondary Science .. .. .. | ☐ | ☐ | 48–49 |
| **Projects supported by Schools Council** | | | |
| Integrated Science Project (SCISP) .. | ☐ | ☐ | 50–51 |
| Science 5–13 .. .. .. | ☐ | ☐ | 52–53 |
| Project Technology .. .. .. | ☐ | ☐ | 54–55 |
| Loughborough Engineering Science .. | ☐ | ☐ | 56–57 |
| Keele Integrated Studies .. .. | ☐ | ☐ | 58–59 |
| Environmental Studies .. .. | ☐ | ☐ | 60–61 |
| Project Environment .. .. | ☐ | ☐ | 62–63 |
| **Others** | | | |
| Scottish Integrated Science .. .. | ☐ | ☐ | 64–65 |
| Your School or LEA project (please name)<br>................................................................................ | ☐ | ☐ | 66–67 |
| | | | 68–69 |
| | | | 70–71 |

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For office use

**Section 3. Facilitating and limiting factors relating to the use of specified projects**

| | |
|---|---|
| | ------ |
| | 2 7 |
| **(a) PLEASE NAME A CURRICULUM PROJECT WITH WHICH YOU ARE MOST FAMILIAR OR USE MOST –** | |
| ........................................................................................ | 8–9 |
| **(b) PLEASE NAME A CURRICULUM PROJECT WHICH YOU FIND LEAST USEFUL OR HAVE REJECTED –** | 10–11 |
| ........................................................................................ | 12–13 |
| | 14–15 |
| **IF YOU HAVE CONSIDERED AND REJECTED OTHER PROJECTS PLEASE NAME –** | |
| ........................................................................................ | 16–17 |

*Please select from the code on the right the number that represents the extent you feel the following factors limit or facilitate use of the projects you have named after (a) and (b) above.*

5 – strongly facilitating
4 – facilitating
3 – no influence
2 – limiting
1 – strongly limiting

| | (a) *most familiar or used* | (b) *least useful or rejected* | |
|---|---|---|---|
| rate of turnover of teaching staff .. .. .. .. | ☐ | ☐ | 18–19 |
| time available for preparation .. .. .. .. | ☐ | ☐ | 20–21 |
| availability of special grants to start project .. .. .. | ☐ | ☐ | 22–23 |
| availability of money to keep project going .. .. .. | ☐ | ☐ | 24–25 |
| accommodation available .. .. .. .. .. | ☐ | ☐ | 26–27 |
| effects of secondary re-organization .. .. .. | ☐ | ☐ | 28–29 |
| school organization .. .. .. .. .. | ☐ | ☐ | 30–31 |
| requirements of external examinations .. .. .. | ☐ | ☐ | 32–33 |
| flexibility of use of project materials .. .. .. | ☐ | ☐ | 34–35 |
| availability of Mode 3 CSE .. .. .. .. | ☐ | ☐ | 36–37 |
| ability and age range of pupils .. .. .. .. | ☐ | ☐ | 38–39 |
| availability of technicians .. .. .. .. | ☐ | ☐ | 40–41 |
| developments related to raising the school leaving age .. | ☐ | ☐ | 42–43 |
| attitude of colleagues in your school .. .. .. | ☐ | ☐ | 44–45 |
| activity of LEA teachers' centre .. .. .. .. | ☐ | ☐ | 46–47 |
| activity of other institutions .. .. .. .. | ☐ | ☐ | 48–49 |
| support by LEA for attending courses .. .. .. | ☐ | ☐ | 50–51 |
| activities of LEA advisory service .. .. .. .. | ☐ | ☐ | 52–53 |
| availability of information about curriculum project .. .. | ☐ | ☐ | 54–55 |
| contacts with trial schools involved in project .. .. | ☐ | ☐ | 56–57 |
| similarity of content or methods in the project with previous teaching | ☐ | ☐ | 58–59 |
| objectives of project .. .. .. .. .. .. | ☐ | ☐ | 60–61 |
| provision of special examinations related to the project .. | ☐ | ☐ | 62–63 |
| pupil's need for a formal qualification .. .. .. | ☐ | ☐ | 64–65 |
| your pre-service education at college or university .. .. | ☐ | ☐ | 66–67 |
| other ........................................................................ | ☐ | ☐ | 68–69 |

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*For Office use*

- - - - - -

3 7

**Section 4. Sources of information**

## HOW FREQUENTLY DO YOU READ THE FOLLOWING?

*Please use code to the right to answer all items on this page.*

5 – regularly
4 – often
3 – occasionally
2 – seldom
1 – never

| *Identification No.* | | | |
|---|---|---|---|
| 01 | publications of the Association for Science Education | ☐ | 8 |
| 02 | other specialist subject journals | ☐ | 9 |
| 03 | science journals and magazines | ☐ | 10 |
| 04 | 'Times Educational Supplement' | ☐ | 11 |
| 05 | other educational journals | ☐ | 12 |
| 06 | DES memoranda and circulars | ☐ | 13 |
| 07 | LEA circulars | ☐ | 14 |
| 08 | Schools Council 'Project Profiles and Index' | ☐ | 15 |
| 09 | Schools Council 'Dialogue' | ☐ | 16 |
| 10 | other Schools Council Publications | ☐ | 17 |
| 11 | circulars from curriculum development projects | ☐ | 18 |
| 12 | information from publishers | ☐ | 19 |
| 13 | catalogues from scientific supply companies | ☐ | 20 |

## HOW OFTEN DO YOU CONSULT WITH THE FOLLOWING PEOPLE FOR INFORMATION?

| | | | |
|---|---|---|---|
| 14 | science teachers from your own school | ☐ | 21 |
| 15 | your head teacher | ☐ | 22 |
| 16 | science teachers from other schools | ☐ | 23 |
| 17 | teachers' centre staff | ☐ | 24 |
| 18 | LEA science advisers/inspectors | ☐ | 25 |
| 19 | teachers from curriculum development project trials | ☐ | 26 |
| 20 | staff from curriculum development projects | ☐ | 27 |
| 21 | Schools Council field officers | ☐ | 28 |
| 22 | H.M.I.s | ☐ | 29 |
| 23 | university staff | ☐ | 30 |
| 24 | staff of other higher education institutions | ☐ | 31 |

*For office use*

**HOW OFTEN DO YOU USE THE FOLLOWING SOURCES?**

5 – regularly
4 – often
3 – occasionally
2 – seldom
1 – never

| *Identification number* | | | |
|---|---|---|---|
| 25 | T.V. educational programmes | ☐ | 32 |
| 26 | radio educational programmes | ☐ | 33 |

**HOW OFTEN ARE YOU ABLE TO ATTEND MEETINGS OR COURSES ORGANISED BY THE FOLLOWING GROUPS?**

4 – attend all or most
3 – attend many
2 – attend a few
1 – do not attend

| | | | |
|---|---|---|---|
| 27 | teachers' professional association | ☐ | 34 |
| 28 | specialist subject association (e.g. A.S.E.) | ☐ | 35 |
| 29 | your LEA | ☐ | 36 |
| 30 | professional centre, e.g. Royal Institute of Chemistry Centre, Biology Centre | ☐ | 37 |
| 31 | university | ☐ | 38 |
| 32 | other higher or further education institutions | ☐ | 39 |
| 33 | Department of Education and Science | ☐ | 40 |
| 34 | examinations board | ☐ | 41 |

### Section 5. Ranking of information sources

**WOULD YOU PLEASE RANK UP TO FIVE OF THE 34 SOURCES LISTED IN SECTION 4 IN TERMS OF RELATIVE USEFULNESS FOR INFORMATION ABOUT CURRICULUM DEVELOPMENT PROJECTS.**
**PLEASE ENTER THE 'IDENTIFICATION NUMBERS' (from 01 to 34) BELOW WITH THE MOST USEFUL IN THE TOP BOX –**

| | |
|---|---|
| ☐ | 42–43 |
| ☐ | 44–45 |
| ☐ | 46–47 |
| ☐ | 48–49 |
| ☐ | 50–51 |

**Section 6. The role of the science adviser or inspector**

4 – very important
3 – of some importance
2 – of little importance
1 – of no importance

**PLEASE INDICATE HOW IMPORTANT YOU FIND OR WOULD ANTICIPATE FINDING THE FOLLOWING ROLES OF AN LEA SCIENCE ADVISER –**

| | | *For office use* |
|---|---|---|
| To participate in the appointment of science teachers .. .. .. .. | ☐ | 52 |
| To supervise and assess probationary science teachers .. .. .. | ☐ | 53 |
| To ensure that safety regulations are fully observed in school science laboratories .. .. .. .. | ☐ | 54 |
| To ensure that head teachers are fully informed about curriculum developments in school science .. .. .. | ☐ | 55 |
| To ensure that science teachers are fully informed about curriculum developments in school science .. .. .. | ☐ | 56 |
| To recognize, support and disseminate successful local developments in science teaching .. .. .. | ☐ | 57 |
| To organize in-service courses in science teaching .. .. .. .. | ☐ | 58 |
| To inform teachers of the provision of resources by the LEA and other agencies .. .. .. .. | ☐ | 59 |
| To advise the Authority on policy and financial or other resources for school science .. .. .. .. | ☐ | 60 |
| To consult with teachers on the provision of resources .. .. .. | ☐ | 61 |
| To advise the Authority on laboratory design .. .. .. .. .. | ☐ | 62 |
| To encourage teachers to use resources .. .. .. .. .. .. | ☐ | 63 |

P.13

For office use

## Section 7. Outcomes of science teaching

SOME OF THE POSSIBLE OUTCOMES OF A PUPIL'S EXPERIENCE IN SCIENCE ARE LISTED BELOW. WE WOULD LIKE TO KNOW THE EXTENT TO WHICH YOUR OPINION OF THEIR IMPORTANCE COMPARES WITH THE IMPORTANCE GIVEN TO THEM BY THE CURRICULUM DEVELOPMENT PROJECT(S) WITH WHICH YOU ARE MOST FAMILIAR.

Under Column (a) indicate your personal opinion of the importance of the outcomes.

Under Column (b) indicate your impression of the importance given to the outcomes by the project(s) you are most familiar with.

*please use this code*

5 – very important
4 – of considerable importance
3 – average importance
2 – of some importance
1 – of no importance

64–65

| | (a) personal | (b) project(s) | |
|---|---|---|---|
| A knowledge of the basic facts of science .. .. .. .. | ☐ | ☐ | 66–67 |
| The development of experimental skills .. .. .. .. | ☐ | ☐ | 68–69 |
| The development of critical attitudes towards the effects of technology on the quality of life .. .. .. | ☐ | ☐ | 70–71 |
| An ability to handle the investigation of open-ended problems .. .. | ☐ | ☐ | 72–73 |
| Educational benefits of individual sciences .. .. .. .. | ☐ | ☐ | 74–75 |
| An understanding of theoretical concepts .. .. .. .. | ☐ | ☐ | 76–77 |
| The development of pupils' ability to work together .. .. .. | ☐ | ☐ | 78–79 |
| | | | – – – – – – |
| Preparation for future studies .. .. .. .. .. | ☐ | ☐ | 4 7–9 |
| The supply of well-qualified scientists and technologists for the nation's needs .. .. .. | ☐ | ☐ | 10–11 |
| Confidence in proposing creative solutions to problems .. .. | ☐ | ☐ | 12–13 |
| A critical attitude towards authority .. .. .. .. | ☐ | ☐ | 14–15 |
| An appreciation of the contributions individuals may make in a group situation .. .. .. .. | ☐ | ☐ | 16–17 |
| An understanding of and ability to use the scientific method .. .. | ☐ | ☐ | 18–19 |
| The ability to use science in everyday life .. .. .. .. | ☐ | ☐ | 20–21 |
| The ability to take personal responsibility for planning and conducting one's own learning experience .. .. | ☐ | ☐ | 22–23 |
| An understanding of the social implications of scientific discovery .. | ☐ | ☐ | 24–25 |
| The ability to delay conclusions until convincing evidence is available .. | ☐ | ☐ | 26–27 |
| Favourable attitudes toward science .. .. .. .. | ☐ | ☐ | 28–29 |
| To facilitate competition with other countries in science and technology | ☐ | ☐ | 30–31 |
| Other ........................................ | | | |
| ........................................ | ☐ | ☐ | 32–33 |

*For office use*

**Section 8. Effects of curriculum projects**

SOME OF THE POSSIBLE EFFECTS OF CURRICULUM RESEARCH AND DEVELOPMENT PROJECTS ARE LISTED BELOW. PLEASE INDICATE YOUR OPINION OF THEIR SIGNIFICANCE BY USE OF THE CODE TO THE RIGHT.

5 – agree strongly
4 – agree
3 – undecided
2 – disagree
1 – disagree strongly

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO –

| | | |
|---|---|---|
| improve the quality of pupils' school experience | ☐ | 34 |
| support those teachers who are already attempting to bring about change in schools | ☐ | 35 |
| over-emphasize the role of technical aids in teaching (e.g. programmed learning) | ☐ | 36 |
| provide resources from which teachers may select | ☐ | 37 |
| increase the burden of preparation for teachers | ☐ | 38 |
| provide packages that can be fully adopted | ☐ | 39 |
| promise more improvements than can reasonably be expected | ☐ | 40 |
| introduce new methods of teaching into the schools | ☐ | 41 |
| enable an atypical group to impose unrealistic standards for the rest of the schools' population | ☐ | 42 |
| provide schemes for teaching based on the psychology of learning | ☐ | 43 |
| promote dissatisfaction with what has been tested over time and shown to work | ☐ | 44 |
| demonstrate how new subject matter may be introduced at school level | ☐ | 45 |
| promote the use of behavioural objectives | ☐ | 46 |
| widen the aims and objectives of teaching a subject | ☐ | 47 |
| maintain specialist divisions between subjects | ☐ | 48 |
| provide alternatives for schools programmes | ☐ | 49 |
| support classification of children into ability groups | ☐ | 50 |
| influence changes in external examinations | ☐ | 51 |
| appeal to "band-wagon" participation by teachers | ☐ | 52 |
| influence the internal organization of schools (time-tabling, streaming, etc) | ☐ | 53 |
| provide a means of promoting personal status | ☐ | 54 |
| discourage innovation because of the mutiplicity of projects | ☐ | 55 |
| encourage LEAs to provide improved facilities | ☐ | 56 |
| provide idealists with a platform | ☐ | 57 |
| increase outside support for change in schools | ☐ | 58 |
| create feelings of inadequacy in teachers | ☐ | 59 |
| support the influence of schools on local government education policy | ☐ | 60 |
| introduce uniformity into school programmes | ☐ | 61 |
| support the influence of schools on national government education policy | ☐ | 62 |
| | | 63–66 |

THANK YOU FOR YOUR CO-OPERATION

APPENDIX P.iii.

CURRICULUM DIFFUSION RESEARCH PROJECT
Centre for Science Education,
Chelsea College, Bridges Place, S.W.6.

## HEAD TEACHER QUESTIONNAIRE

8% sample -
N = 289

**Section 1.** School information (please circle correct answer.)

WHICH ONE OF THE FOLLOWING BEST DESCRIBES THE ABILITY RANGE OF PUPILS IN YOUR SCHOOLS?

| | |
|---|---|
| 0 - no response | 9 |
| 1 - grammar or technical grammar | 61 |
| 2 - secondary modern | 123 |
| 3 - comprehensive with fully representative ability range for area | 66 |
| 4 - comprehensive but some (less than 10%) able pupils from area going to a grammar school | 16 |
| 5 - comprehensive but many (10% or over) of able pupils from area going to a grammar school | 14 |
| 6 - 6th form college | 0 |
| | 289 |

IF YOUR SCHOOL IS AT PRESENT UNDERGOING RE-ORGANIZATION (OR DID LAST YEAR OR WILL WITHIN THE NEXT 3 YEARS) PLEASE INDICATE THE TYPE OF CHANGE -

| | |
|---|---|
| 0 - no change | 116 |
| 1 - secondary modern to comprehensive | 91 |
| 2 - grammar to comprehensive | 28 |
| 3 - grammar and secondary modern to comprehensive | 9 |
| 4 - other: | |
| changing to comprehensive | 8 |
| changing to middle school | 5 |
| changing age range (wider or more restricted) | 5 |
| just opening or being closed | 2 |
| change size | 2 |
| change ability range | 1 |
| combine boys and girls | 2 |
| guided parent lines | 1 |
| Thames scheme | 1 |
| uncertain, or not specified | 14 |
| | 289 |

## Section 1 (contd.)

WHAT IS THE AGE RANGE OF YOUR PUPILS?

| | |
|---|---|
| 0 - no response | 0 |
| 1 - 11 to 13 | 3 |
| 2 - 11 to 14 | 5 |
| 3 - 11 to 16 | 118 |
| 4 - 11 to 18 | 131 |
| 5 - 13 to 16 | 0 |
| 6 - 13 to 18 | 6 |
| 7 - 16 to 18 | 0 |
| 8 - other | 26 |
| | 289 |

WHAT IS THE SEX OF PUPILS?

| | |
|---|---|
| 0 - no response | 1 |
| 1 - boys | 40 |
| 2 - girls | 38 |
| 3 - mixed | 210 |
| | 289 |

HOW MANY PUPILS ARE THERE IN YOUR SCHOOL?

| | |
|---|---|
| 120 - 400 | 58 |
| 401 - 600 | 74 |
| 601 - 800 | 83 |
| 801 - 4030 | 74 |
| | 289 |

## Section 2. Individual information

### Variables 006 and 007

HOW MANY YEARS HAVE YOU BEEN IN YOUR PRESENT SCHOOL AS A HEAD TEACHER?
HOW MANY YEARS IN ALL HAVE YOU BEEN A HEAD TEACHER?

| Years | Experience as head in present school | Total years as head teacher |
|---|---|---|
| 1 | 48 | 33 |
| 2 | 29 | 21 |
| 3 | 29 | 18 |
| 4 | 17 | 12 |
| 5 | 13 | 12 |
| 6 | 25 | 22 |
| 7 | 15 | 21 |
| 8 | 11 | 6 |
| 9 | 8 | 6 |
| 10 | 14 | 10 |
| 11 | 13 | 10 |
| 12 | 9 | 15 |
| 13 | 5 | 9 |
| 14 | 11 | 11 |
| 15 | 5 | 5 |
| 16 | 11 | 14 |
| 17 | 4 | 12 |
| 18 | 4 | 3 |
| 19 | 3 | 5 |
| 20 | 5 | 11 |
| 21 | 1 | 6 |
| 22 | 1 | 6 |
| 23 | 3 | 4 |
| 24 | - | 3 |
| 25 | 2 | 2 |
| 26 | - | 2 |
| 27 | - | - |
| 28 | - | 2 |
| 29 | 1 | 2 |
| 30 | 1 | 1 |
| + | 1 | 4 |

**Combined 006**

| | Frequency | % |
|---|---|---|
| 1 - 3 | 106 | 37 |
| 4 - 8 | 81 | 28 |
| 9+ | 102 | 35 |

**Combined 007**

| | Frequency | % |
|---|---|---|
| 1 - 3 | 118 | 41 |
| 4 - 8 | 89 | 31 |
| 9+ | 82 | 28 |

## Section 2 (contd.)

IN WHAT SUBJECT AREA DID YOU OBTAIN YOUR QUALIFICATION AT COLLEGE OR UNIVERSITY?

| | |
|---|---|
| 0 - no response | 1 |
| 1 - humanities | 163 |
| 2 - social sciences | 13 |
| 3 - science/technology | 45 |
| 4 - mathematics | 23 |
| 5 - other: | |
| languages (including classics) | 15 |
| geography | 7 |
| art and craft | 4 |
| music, theology, general (2 each) | 6 |
| law, education, physical education, economics, science (1 each) | 5 |
| unspecified | 7 |
| | 289 |

DO YOU PRESENTLY TEACH IN YOUR SUBJECT AREA?

| | |
|---|---|
| 0 - no response | 2 |
| 1 - Yes | 155 |
| 2 - No | 132 |
| | 289 |

## Section 3. Project influence

In my opinion the project materials have -

5 - considerable desirable effects
4 - some desirable effects
3 - no effects
2 - some undesirable effects
1 - considerable undesirable effects

| | | Mean rating of influence ('0' excluded) | Number of responses to each rating of influence | | | | | Total Responses |
|---|---|---|---|---|---|---|---|---|
| | | | 5 | 4 | 3 | 2 | 1 | |
| **Projects supported by Schools Council** | | | | | | | | |
| Environmental Studies | 010 | 3.8 | 14 | 53 | 32 | 1 | 0 | 105 |
| General Studies Project | 017 | 3.7 | 14 | 45 | 42 | 0 | 1 | 102 |
| Humanities Curriculum Project | 024 | 3.9 | 23 | 94 | 26 | 4 | 3 | 150 |
| Integrated Science (SCISP) | 031 | 3.5 | 9 | 26 | 35 | 2 | 1 | 73 |
| Keele Integrated Studies | 038 | 3.5 | 9 | 22 | 35 | 1 | 1 | 68 |
| Loughborough Engineering Sc. | 045 | 3.2 | 0 | 10 | 35 | 0 | 0 | 45 |
| Mathematics for the Majority | 052 | 3.6 | 6 | 39 | 37 | 1 | 0 | 83 |
| Mathematics for the Majority Continuation Project | 059 | 3.4 | 3 | 16 | 30 | 0 | 0 | 49 |
| Midlands Mathematics Experiment | 066 | 3.6 | 10 | 26 | 38 | 2 | 0 | 76 |
| Moral Education 13-16 | 073 | 3.5 | 5 | 28 | 36 | 1 | 0 | 70 |
| North-West Regional Curriculum Development Project | 080 | 3.6 | 6 | 23 | 28 | 0 | 0 | 57 |
| Project Environment | 087 | 3.3 | 2 | 6 | 30 | 0 | 0 | 38 |
| Project Technology | 094 | 3.9 | 21 | 55 | 29 | 0 | 2 | 107 |
| Science 5 - 13 | 101 | 3.5 | 4 | 16 | 32 | 0 | 0 | 52 |
| **Nuffield Projects** | | | | | | | | |
| O-level Biology | 108 | 4.1 | 39 | 76 | 19 | 2 | 0 | 136 |
| O-level Chemistry | 115 | 4.0 | 37 | 64 | 25 | 3 | 0 | 129 |
| O-level Physics | 122 | 4.1 | 38 | 68 | 24 | 3 | 0 | 133 |
| A-level Biological Science | 129 | 3.7 | 11 | 21 | 28 | 0 | 0 | 60 |
| A-level Chemistry | 136 | 3.8 | 19 | 27 | 30 | 1 | 0 | 77 |
| A-level Physics | 143 | 3.7 | 11 | 28 | 30 | 1 | 0 | 70 |
| A-level Physical Science | 150 | 3.3 | 4 | 8 | 34 | 2 | 0 | 48 |
| Combined Science | 157 | 4.2 | 52 | 48 | 23 | 1 | 1 | 125 |
| Secondary Science | 164 | 4.2 | 38 | 44 | 19 | 1 | 0 | 102 |
| Nuffield Mathematics | 171 | 3.6 | 10 | 35 | 31 | 3 | 1 | 80 |
| **Other** | | | | | | | | |
| Scottish Integrated Science | 178 | 3.5 | 7 | 6 | 29 | 0 | 0 | 42 |
| Total | | | 392 | 889 | 757 | 29 | 10 | 2077 |
| | | | 18.9% | 42.8% | 36.4% | 1.4% | 0.5% | |

**Section 3 (contd.)** **Project familiarity**

Please tick .✓. in the columns (B-G) after each curriculum project the statements which are correct in your case.
LEAVE SPACE BLANK IF YOU DO NOT KNOW.

I am aware of the following aspects of the project -

| | | (B) the project's existence | (C) age and ability range | (D) main objectives | (E) main teaching methods | (F) materials produced or planned | (G) approx. cost of adoption | Total frequency | % of total |
|---|---|---|---|---|---|---|---|---|---|
| **Projects supported by Schools Council** | | | | | | | | | |
| 011-016 | Environmental Studies | 169 | 104 | 115 | 88 | 52 | 36 | 564 | 5.1 |
| 018-023 | General Studies Project | 143 | 95 | 92 | 72 | 58 | 45 | 505 | 4.5 |
| 025-030 | Humanities Curriculum Project | 201 | 162 | 166 | 146 | 134 | 110 | 919 | 8.2 |
| 032-037 | Integrated Science (SCISP) | 127 | 80 | 74 | 58 | 37 | 27 | 403 | 3.6 |
| 039-044 | Keele Integrated Studies | 92 | 53 | 53 | 41 | 35 | 19 | 293 | 2.6 |
| 046-051 | Loughborough Engineering Scien | 56 | 21 | 19 | 13 | 12 | 8 | 129 | 1.2 |
| 053-058 | Mathematics for the Majority | 136 | 77 | 71 | 52 | 37 | 27 | 400 | 3.6 |
| 060-065 | Mathematics for the Majority Continuation Project | 60 | 37 | 31 | 27 | 22 | 15 | 192 | 1.7 |
| 067-072 | Midlands Mathematics Experiment | 106 | 54 | 51 | 46 | 37 | 23 | 317 | 2.8 |
| 074-079 | Moral Education 13-16 | 122 | 78 | 75 | 47 | 41 | 30 | 393 | 3.5 |
| 081-086 | North-West Regional Curriculum Development Project | 79 | 48 | 47 | 38 | 32 | 23 | 267 | 2.4 |
| 088-093 | Project Environment | 39 | 11 | 12 | 10 | 9 | 5 | 86 | 0.8 |
| 095-100 | Project Technology | 137 | 96 | 100 | 80 | 62 | 39 | 514 | 4.6 |
| 102-107 | Science 5-13 | 65 | 41 | 32 | 26 | 14 | 9 | 187 | 1.7 |
| **Nuffield Projects** | | | | | | | | | |
| 109-114 | O-level Biology | 189 | 152 | 145 | 134 | 113 | 100 | 833 | 7.5 |
| 116-121 | O-level Chemistry | 186 | 150 | 144 | 134 | 111 | 99 | 824 | 7.4 |
| 123-128 | O-level Physics | 186 | 151 | 146 | 134 | 116 | 105 | 838 | 7.5 |
| 130-135 | A-level Biological Science | 109 | 79 | 64 | 49 | 36 | 29 | 366 | 3.3 |
| 137-142 | A-level Chemistry | 131 | 95 | 79 | 64 | 56 | 45 | 470 | 4.2 |
| 144-149 | A-level Physics | 123 | 96 | 78 | 61 | 49 | 41 | 448 | 4.0 |
| 151-156 | A-level Physical Science | 101 | 69 | 51 | 38 | 22 | 16 | 297 | 2.7 |
| 158-163 | Combined Science | 167 | 128 | 119 | 110 | 93 | 85 | 702 | 6.3 |
| 165-170 | Secondary Science | 153 | 116 | 113 | 101 | 86 | 71 | 640 | 5.4 |
| 172-177 | Nuffield Mathematics | 138 | 84 | 77 | 63 | 50 | 34 | 446 | 4.0 |
| **Other** | | | | | | | | | |
| 179-184 | Scottish Integrated Science | 33 | 22 | 18 | 15 | 13 | 11 | 112 | 1.0 |
| | Total | 3048 | 2099 | 1972 | 1647 | 1327 | 1052 | 11,145 | 99.6 |
| | | 27.3% | 18.8% | 17.7% | 14.8% | 11.9% | 9.4% | 99.6% | |

**Section 3** (contd.) **Project familiarity**

**Responses to 0-6 categories of familiarity**

| | | Number of responses for each project | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | Mean |
| **Projects supported by Schools Council** | | | | | | | | | |
| 011-016 | Environmental Studies | 116 | 55 | 11 | 23 | 35 | 16 | 33 | 1.9 |
| 018-023 | General Studies Project | 144 | 43 | 13 | 17 | 16 | 15 | 41 | 1.7 |
| 025-030 | Humanities Curriculum Project | 85 | 31 | 11 | 16 | 16 | 26 | 36 | 3.2 |
| 032-037 | Integrated Science (SCISP) | 161 | 43 | 12 | 17 | 20 | 11 | 25 | 1.4 |
| 039-044 | Keele Integrated Studies | 197 | 34 | 9 | 7 | 7 | 18 | 17 | 1.0 |
| 046-051 | Loughborough Engineering Science | 233 | 34 | 4 | 5 | 1 | 4 | 8 | 0.4 |
| 053-058 | Mathematics for the Majority | 150 | 59 | 13 | 15 | 15 | 12 | 25 | 1.4 |
| 060-065 | Mathematics for the Majority Continuation Project | 227 | 25 | 5 | 6 | 4 | 9 | 13 | 0.7 |
| 067-072 | Midlands Mathematics Experiment | 181 | 51 | 5 | 8 | 8 | 16 | 20 | 1.1 |
| 074-079 | Moral Education 13-16 | 165 | 39 | 14 | 21 | 12 | 13 | 25 | 1.4 |
| 081-086 | North-West Regional Curriculum Development Project | 210 | 29 | 5 | 5 | 9 | 9 | 22 | 0.9 |
| 088-093 | Project Environment | 250 | 27 | 1 | 1 | 1 | 4 | 5 | 0.3 |
| 095-100 | Project Technology | 149 | 37 | 9 | 14 | 22 | 19 | 39 | 1.8 |
| 102-107 | Science 5-13 | 224 | 23 | 10 | 5 | 14 | 5 | 8 | 0.6 |
| **Nuffield Projects** | | | | | | | | | |
| 109-114 | O-level Biology | 95 | 37 | 14 | 10 | 20 | 20 | 93 | 2.9 |
| 116-121 | O-level Chemistry | 98 | 36 | 13 | 9 | 22 | 19 | 92 | 2.8 |
| 123-128 | O-level Physics | 97 | 36 | 13 | 10 | 17 | 18 | 98 | 2.9 |
| 130-135 | A-level Biological Science | 178 | 31 | 17 | 13 | 15 | 8 | 27 | 1.3 |
| 137-142 | A-level Chemistry | 161 | 28 | 24 | 8 | 13 | 14 | 40 | 1.6 |
| 144-149 | A-level Physics | 162 | 28 | 23 | 13 | 16 | 11 | 36 | 1.5 |
| 151-156 | A-level Physical Science | 186 | 34 | 20 | 11 | 16 | 6 | 16 | 1.0 |
| 158-163 | Combined Science | 118 | 39 | 14 | 8 | 18 | 13 | 79 | 2.4 |
| 165-170 | Secondary Science | 133 | 34 | 11 | 10 | 18 | 16 | 67 | 2.2 |
| 172-177 | Nuffield Mathematics | 148 | 51 | 19 | 8 | 13 | 19 | 31 | 1.5 |
| **Other** | | | | | | | | | |
| 179-184 | Scottish Integrated Science | 256 | 11 | 4 | 3 | 2 | 2 | 11 | 0.4 |

## Section 4 Involvement in projects

A. Projects named whose materials are used fully or in part in the school. (Variables 185-195)

B Participation of school in trials of project (Variables 197-202)

| | A | % of total column A (786) | % of total schools | B |
|---|---|---|---|---|
| **Projects supported by Schools Council** | | | | |
| Environmental Studies | 28 | 3.6 | 9.7 | 1 |
| General Studies Project | 30 | 3.8 | 10.4 | 2 |
| Humanities Curriculum Project | 84 | 10.7 | 29.1 | 6 |
| Integrated Science (SCISP) | 4 | 0.5 | 1.4 | 1 |
| Keele Integrated Studies | 6 | 0.8 | 2.1 | 1 |
| Loughborough Engineering Science | 3 | 0.4 | 1.0 | - |
| Mathematics for the Majority | 20 | 2.5 | 6.9 | 10 |
| Mathematics for the Majority Continuation Project | 11 | 1.4 | 3.8 | 5 |
| Midlands Mathematics Experiment | 12 | 1.5 | 4.2 | 1 |
| Moral Education 13-16 | 14 | 1.8 | 4.8 | 1 |
| North-West Regional Curriculum Development Project | 20 | 2.5 | 6.9 | 8 |
| Project Environment | 1 | 0.1 | 0.3 | - |
| Project Technology | 33 | 4.2 | 11.4 | 6 |
| Science 5-13 | 1 | 0.1 | 0.3 | 1 |
| **Nuffield Projects** | | | | |
| O-level Biology | 99 | 12.6 | 34.2 | 2 |
| O-level Chemistry | 86 | 10.9 | 29.8 | 3 |
| O-level Physics | 92 | 11.7 | 31.8 | 3 |
| A-level Biological Science | 22 | 2.8 | 7.6 | 1 |
| A-level Chemistry | 30 | 3.8 | 10.4 | 1 |
| A-level Physics | 22 | 2.8 | 7.6 | 3 |
| A-level Physical Science | 1 | 0.1 | 0.3 | 1 |
| Combined Science | 81 | 10.3 | 28.0 | 3 |
| Secondary Science | 56 | 7.1 | 19.4 | 14 |
| Nuffield Mathematics | 23 | 2.9 | 8.0 | 7 |
| **Other** | | | | |
| Scottish Integrated Science | 7 | 0.9 | 2.4 | - |
| | 786 | | | 81 |

## Section 4 (contd.) Involvement in projects

A. Number of times projects are named (0 to 10 different projects) is used (variables 185-195)

| No. of Projects | No. of times named | Frequency | Cumulative frequency |
|---|---|---|---|
| 0 | 49 | 17.0 | |
| 1 | 55 | 19.0 | 36.0 |
| 2 | 55 | 19.0 | 55.0 |
| 3 | 41 | 14.2 | 69.2 |
| 4 | 32 | 11.1 | 80.3 |
| 5 | 17 | 5.9 | 86.2 |
| 6 | 17 | 5.9 | 92.0 |
| 7 | 12 | 4.2 | 96.2 |
| 8 | 5 | 1.7 | 97.9 |
| 9 | 2 | 0.7 | 98.6 |
| 10 | 4 | 1.4 | 100.0 |

| | |
|---|---|
| Mean | 2.72 |
| Mode | 1.00 |
| Kurtosis | 0.45 |
| Standard error | 0.136 |
| Standard deviation | 2.30 |
| Skew | 0.94 |
| Median | 2.24 |
| Variance | 5.32 |

B. Total named for trial (203)

| | | | | |
|---|---|---|---|---|
| 0 | 222 | 4 | 0 | |
| 1 | 54 | 5 | 0 | |
| 2 | 11 | 6 | 0 | |
| 3 | 1 | 7 | 1 | 289 |

## Section 4 (Contd.) Involvement in projects

### Projects named in addition to those listed on the questionnaire

| Project | No. of times Named |
|---|---|
| S.M.P. Maths | 38 |
| European Studies (Sussex University) | 2 |
| Children as Readers Project | 1 |
| NATE | 1 |
| Own project - liaison with York University Curricula Dev. Group | 1 |
| Audio visual language teaching | 1 |
| Programmed Latin course | 1 |
| National Computing Centre - ROSLA Project | 1 |
| NFER Publications of Research Work | 3 |
| V.C.O.A.D. | 1 |
| Nuffield French | 9 |
| Cambridge Non-Linguistic Classical Foundation Course (Latin) | 7 |
| S.C. Craft and Design Education Project | 3 |
| Own Social Studies Project - with team teaching | 1 |
| Own Environmental Studies Project - with team teaching | 1 |
| S.C. Lancaster University Religious Education Project | 4 |
| Careers Guidance Project, Schools Council | 3 |
| Common 16+ Feasibility Studies in Maths | 1 |
| Education for Personal Relationships/Counselling Projects | 1 |
| Own Curriculum Development | 5 |
| Teaching of English as 2nd language to immigrants | 1 |
| Modern languages project | 2 |
| J.M.B. O-level Experimental Biology Syllabus | 1 |
| English "Situations" | 1 |
| S.C. Welsh as 1st language (Bangor) | 1 |
| Projects specially developed in connection with ROSLA | 2 |
| Own Environmental Studies | 3 |
| Integrated Humanities | 1 |
| Mode 3 CSE projects etc. | 5 |
| Herts C.C. - "Education for Personal Relationships" | 1 |
| Computer-aided Maths (link with Hatfield School) | 1 |
| Creative design - own project | 1 |
| Lower School combined science - own project | 1 |
| Goldsmiths I.D.E. (Goldsmiths Curriculum Laboratory) | 5 |
| I.C.L. Computer Science | 1 |
| School of African and Oriental Studies projects | 1 |
| Own Humanities/Moral Education Project | 1 |
| Nuffield German | 2 |
| Own Integrated Humanities years 1-3 ) Supported by Oxford | 1 |
| Own Integrated Studies " 4-5 ) Curriculum Development | 1 |
| S.C. Geography History Project | 1 |
| Liaison with outside bodies - ROSPA, Health Authorities, P.E. Colleges, etc. | 1 |
| Previous projects on 'Modern' Maths | 1 |
| Team teaching - Humanities | 1 |
| J. Bruner 'Man - a course of study' 14-16 year olds - trials | 2 |

Section 4 (Contd.) Involvement in projects

| Project | No. of times named |
|---|---|
| Integrated Science in first 2 years | 1 |
| Development of integrated course in the history of England and Wales in lower forms of secondary schools | 1 |
| Miscellaneous testing of materials produced at local Teachers' Centre | 2 |
| Need and innovation in multi-racial education | 1 |
| Stoke-on-Trent ROSLA projects | 1 |
| Integrated Studies | 4 |
| Main articles in "Guardian" and T.E.S. | 1 |
| Integration of Art, Design and Crafts Departments | 2 |
| Science Workshop Project for 1st years | 1 |
| S.C. 6th Form Maths | 2 |
| Nuffield Russian O-level | 1 |
| Team Teaching | 1 |
| Nuffield Physics with Chemistry | 1 |
| Shropshire Maths Experiment | 1 |
| Humanities Course adapted from N.W. Reg. C.D.P. | 1 |
| Alternative to J.M.B. 'A' level practical Physics examination - investigations project (3rd year) | 1 |
| Southampton Mathematics Project | 1 |
| Community Services Volunteers Project | 1 |
| Social Studies (8-13) S.C.W.P. 39 | 1 |
| Nuffield Spanish | 1 |
| BBC/ITV based projects | 4 |
| I.M.V. Maths project | 1 |
| Developing own art course | 1 |
| New subjects introduced by examining boards - AEB | 1 |
| Humanities Project - Stenhouse | 1 |
| "Private" internal project designed by member of staff | 1 |
| Resources for Independent Learning Techniques | 1 |
| Computer Courses (Fortran/Algol) | 1 |
| Teaching Machines (Science/Maths) | 1 |
| French in Primary Schools | 1 |
| Scottish Maths Project | 1 |
| Penguin English Project | 1 |
| Geography for the Young School Leaver - S.C. | 2 |
| Childwall Social Studies Project "Design for Living" (Liverpool LEA) | 2 |
| 1974 single examination at 16+ (Physics) | 1 |
| S.C. Project Science 5/13 | 1 |
| Helmut McDougal Home Economics Course for 4th year girls | 1 |
| Auto Engineering | 1 |
| Building | 1 |
| Local Projects at City of Birmingham Development Centre | 1 |
| Nuffield Languages | 1 |
| Own brand of Biology to O-level, particularly in lower school | 1 |
| Kent Maths Project | 1 |

## Section 5. Future influences

IN YOUR OPINION, OF WHAT IMPORTANCE MAY THE FOLLOWING DEVELOPMENTS OR PROJECTS BE IN INFLUENCING FUTURE CHANGES IN THE CURRICULUM?

Please circle appropriate number.

| | | Considerable importance | Some importance | Little importance | No importance | No response | Mean |
|---|---|---|---|---|---|---|---|
| | | 4 | 3 | 2 | 1 | 0 | |
| 212 | Educational priority area projects (EPA) | 27 | 66 | 46 | 59 | 91 | 2.3 |
| 213 | comprehensive reorganization | 178 | 63 | 13 | 8 | 27 | 3.6 |
| 214 | raising of the school leaving age | 162 | 85 | 15 | 13 | 14 | 3.4 |
| 215 | reorganization of LEA boundaries | 30 | 65 | 79 | 73 | 42 | 2.2 |
| 216 | reorganization of teacher education | 80 | 123 | 39 | 10 | 37 | 3.1 |
| 217 | other | 35 | 13 | 0 | 0 | 241 | 3.7 |

### Details of variable 217

Variables 218-221.

| | No. of times mentioned |
|---|---|
| Entry into Common Market | 2 |
| Links with Colleges | 2 |
| 12+ reorganization | 1 |
| Linked courses | 1 |
| Teacher re-education in in-service training using local centres | 4 |
| Unified exam structure GCE/CSE | 12 |
| Immigrant community | 1 |
| Community schools | 2 |
| Changing attitude of teachers to their professional obligations i.e. effect of current tendency towards experimentation, innovation and change. | 1 |
| Establishment of teachers' centres | 1 |
| Local Authority decisions on catchment areas | 1 |
| Raising of the status of teachers (A Statutory Teachers' Council of The General Medical Council) | 1 |
| Reorganization of school day so that evening session can be organized for optional subjects, and extra curriculum activities | 1 |
| Assessment and examining, especially at 16+ | 3 |
| The new 6th form | 1 |

## Section 5 (contd.) Future influences

### Details of variable 217 (contd.)

| | No. of times mentioned |
|---|---|
| Money available | 1 |
| LEA advisory service | 1 |
| Increase in population and buildings | 1 |
| Changes in work/careers | 1 |
| Development of resources area | 1 |
| Social changes and attitudes of society, e.g. Health education, R.E. | 1 |
| Computer education in schools | 1 |
| Greater resources for in-service training based on individual schools or departments within a school i.e. shift of emphasis from in-service training for individuals | 1 |
| Pretesting for exam boards | 1 |
| Other testing trends | 2 |
| Increase of ancillary assistants | 1 |
| Development of post of "Director of Studies" | 1 |
| Teachers' salaries | 1 |
| Accommodation for ROSLA courses | 1 |
| LEA support programmes | 1 |
| Re-allocation of Teacher time | 1 |
| Sabbatical leave | 1 |
| Training in pastoral care | 1 |
| Change from single sex to mixed schools | 1 |
| Resources approach | 2 |
| Local reorganization | 1 |
| Open University 2nd/3rd levels. Educational studies when enough teachers have assimilated their "messages" and begin attempting to implement them | 1 |
| New concepts in buildings, materials and resources | 1 |
| Introduction of CSE syllabuses in a wider variety of subjects | 1 |
| Independent learning in all subjects | 1 |

**Note:** Columns 41-48 allowed coding of up to four other influences, but only one in variable 217 was rated.

## Section 6 Usefulness of information sources

Please circle the appropriate number in the columns below to indicate the extent to which you find the following sources of information about curriculum development projects useful -

| | | Very useful 4 | Sometimes useful 3 | Rarely useful 2 | Never useful 1 | No response 0 | Mean |
|---|---|---|---|---|---|---|---|
| | **Impersonal sources** | | | | | | |
| 222 | LEA circulars | 60 | 172 | 37 | 3 | 17 | 3.1 |
| 223 | DES memoranda and circulars | 71 | 163 | 33 | 4 | 18 | 3.1 |
| 224 | information direct from curriculum development projects | 121 | 128 | 21 | 1 | 18 | 3.4 |
| 225 | information from publishers | 30 | 169 | 72 | 3 | 15 | 2.8 |
| 226 | information from supply catalogues | 10 | 117 | 117 | 19 | 26 | 2.4 |
| 227 | 'Times Educational Supplement' | 62 | 160 | 40 | 7 | 20 | 3.0 |
| 228 | Schools Council Dialogue | 113 | 142 | 24 | 2 | 8 | 3.3 |
| 229 | Schools Council Project Profiles and Index | 64 | 116 | 49 | 14 | 46 | 2.9 |
| 230 | other Schools Council publications | 66 | 157 | 32 | 4 | 30 | 3.1 |
| 231 | specialist subject journals | 56 | 136 | 44 | 16 | 37 | 2.9 |
| 232 | other educational journals | 10 | 168 | 54 | 12 | 45 | 2.7 |
| 233 | BBC T.V. educational programmes | 49 | 149 | 54 | 15 | 22 | 2.9 |
| | **Personal sources** | | | | | | |
| 234 | head of departments in your school | 182 | 87 | 6 | 1 | 13 | 3.6 |
| 235 | assistant teachers in your school | 94 | 148 | 27 | 5 | 15 | 3.2 |
| 236 | teachers from other schools | 51 | 152 | 57 | 8 | 21 | 2.9 |
| 237 | staff from schools participating in the trials of a curriculum project | 65 | 90 | 56 | 21 | 57 | 2.9 |
| 238 | head teachers | 67 | 146 | 46 | 7 | 23 | 3.0 |
| 239 | LEA advisers/inspectors | 90 | 122 | 52 | 10 | 15 | 3.1 |
| 240 | Schools Council field officers | 16 | 72 | 67 | 63 | 71 | 2.2 |
| 241 | HMIs | 51 | 134 | 54 | 27 | 23 | 2.8 |
| 242 | university lecturers | 7 | 61 | 92 | 89 | 40 | 1.9 |
| 243 | colleges of education lecturers | 6 | 75 | 100 | 76 | 32 | 2.0 |
| 244 | school governors | 2 | 17 | 86 | 153 | 31 | 1.5 |
| 245 | parents | 7 | 33 | 97 | 123 | 29 | 1.7 |
| | Total | 1350 | 2914 | 1317 | 683 | 672 | |
| | % of total responses | 19.5 | 42.0 | 19.0 | 9.8 | 9.7 | |

## Section 7 Ranking of information sources

Would you please rank up to four of all the sources listed in Section 6 in terms of relative usefulness. Take into consideration both impersonal and personal sources.

| | | | | Weighted mean response |
|---|---|---|---|---|
| Var. 246 | 1 | most useful | Head of departments in your school | 4.0 |
| 247 | 2 | second most useful | Information direct from curriculum development projects | 3.0 |
| 248 | 3 | third most useful | Schools Council 'Dialogue' | 2.7 |
| 249 | 4 | fourth most useful | LEA advisers/inspectors | 2.4 |

| | No. of times mentioned in 246 - 249 | | | | |
|---|---|---|---|---|---|
| **Impersonal sources** | 1st | 2nd | 3rd | 4th | Total |
| LEA circulars | 10 | 11 | 7 | 11 | 39 |
| DES memoranda and circulars | 10 | 12 | 13 | 9 | 44 |
| information direct from curriculum development projects | 44 | 27 | 17 | 13 | 101 |
| information from publishers | 4 | 8 | 10 | 5 | 27 |
| information from supply catalogues | | 1 | 1 | 2 | 4 |
| 'Times Educational Supplement' | 13 | 11 | 8 | 25 | 57 |
| Schools Council 'Dialogue' | 27 | 29 | 23 | 16 | 95 |
| Schools Council Project Profiles and Index | 7 | 6 | 5 | 7 | 25 |
| other Schools Council publications | 7 | 6 | 7 | 7 | 27 |
| specialist subject journals | 5 | 6 | 14 | 6 | 31 |
| other educational journals | | 1 | 1 | 7 | 9 |
| BBC T.V. educational programmes | 8 | 8 | 10 | 19 | 45 |
| **Personal sources** | | | | | |
| head of departments in your school | 74 | 40 | 34 | 19 | 167 |
| assistant teachers in your school | 3 | 23 | 17 | 10 | 53 |
| teachers from other schools | 6 | 7 | 7 | 6 | 26 |
| staff from schools participating in the trials of a curriculum project | 5 | 8 | 14 | 10 | 37 |
| head teachers | 7 | 17 | 12 | 13 | 49 |
| LEA advisers/inspectors | 22 | 25 | 25 | 25 | 97 |
| Schools Council field officers | 1 | | 3 | 2 | 6 |
| HMIs | 3 | 10 | 14 | 14 | 41 |
| university lecturers | 1 | 1 | 2 | 1 | 5 |
| colleges of education lecturers | | 1 | 2 | 1 | 4 |
| school governors | | | | | 0 |
| parents | 1 | 1 | | | 2 |
| Schools Council general | 12 | 7 | 9 | 11 | 39 |

## Section 8 Facilitating and limiting factors relating to your own school

The following list is of factors that may facilitate or limit the taking up of curriculum project materials and ideas.

Please circle the one number after each factor to indicate the extent of influence in your school.

| | | strongly facilitate 5 | moderately facilitate 4 | no effect 3 | moderately limit 2 | strongly limit 1 | no response 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 250 | qualifications of teaching staff | 71 | 84 | 62 | 55 | 7 | 10 | 3.6 |
| 251 | staff turnover | 18 | 30 | 140 | 74 | 14 | 13 | 2.9 |
| 252 | staff overworked | 1 | 14 | 95 | 120 | 42 | 17 | 2.3 |
| 253 | pastoral care of pupils | 22 | 55 | 142 | 47 | 5 | 18 | 3.2 |
| 254 | materials produced for a restricted ability range | 12 | 45 | 81 | 91 | 31 | 29 | 2.7 |
| 255 | university entry requirements | 5 | 9 | 172 | 59 | 17 | 27 | 2.7 |
| 256 | availability of CSE Mode 3 | 45 | 72 | 124 | 18 | 3 | 27 | 3.5 |
| 257 | provisions of special examinations relating to the project | 22 | 55 | 138 | 33 | 7 | 34 | 3.2 |
| 258 | availability of report on project evaluation | 13 | 79 | 116 | 35 | 6 | 40 | 3.2 |
| 259 | availability of money to launch projects | 47 | 33 | 29 | 82 | 92 | 6 | 2.5 |
| 260 | availability of money to maintain projects | 44 | 30 | 34 | 84 | 87 | 10 | 2.5 |
| 261 | adequate accommodation in school | 32 | 37 | 29 | 98 | 88 | 5 | 2.4 |
| 262 | use of school for student teaching practice | 4 | 38 | 184 | 43 | 6 | 14 | 3.0 |
| 263 | active teachers' centre in area | 50 | 124 | 74 | 16 | 9 | 16 | 3.7 |
| 264 | contacts between schools in the area | 29 | 131 | 89 | 17 | 3 | 20 | 3.6 |
| 265 | LEA initiative in innovation | 60 | 118 | 78 | 15 | 2 | 16 | 3.8 |
| 266 | LEA advisory service | 56 | 121 | 83 | 6 | 1 | 22 | 3.8 |
| 267 | school planning for secondary reorganization | 26 | 55 | 120 | 38 | 24 | 26 | 3.1 |
| 268 | influence of secondary reorganization on the school curricula | 29 | 62 | 116 | 36 | 18 | 28 | 3.2 |
| 269 | influence of secondary reorganization on communication with other schools | 20 | 63 | 151 | 19 | 5 | 31 | 3.3 |
| 270 | uncertainty about school reorganization | 7 | 5 | 154 | 52 | 46 | 25 | 2.5 |
| 271 | others (please specify) | 8 | 0 | 4 | 8 | 11 | 258 | |
| | Total | 621 | 1260 | 2215 | 1046 | 524 | 692 | |
| | % of total | 9.8 | 19.8 | 37.8 | 16.4 | 8.2 | 10.9 | |

## Section 8 (contd.) Facilitating and limiting factors relating to your own school

### Factors named in addition to those listed on the questionnaire

| | No. of times named |
|---|---|
| Community facilities | 1 |
| Presence of immigrant pupils | 1 |
| Time table allocation | 1 |
| Attitudes of teaching staff | 3 |
| Limitations of time and energy | 1 |
| Distinction of perspective of course team and teacher | 1 |
| Small size of school limits range of courses | 2 |
| Deliberate school policy of accepting discipline of external examinations and insisting as far as possible on controlled experimentation | 1 |
| Conservatism of teachers | 1 |
| Reactionary attitude of some Heads of Department, particularly in science | 1 |
| Iniative of staff | 3 |
| Traditional school created from a grammar school where academic strength held to be most important feature of school | 1 |
| Reorganization from 11-16 comprehensive to middle school | 1 |
| Opportunity to select staff interested in curriculum development | 1 |
| Staff subject-mindedness | 1 |
| Too many projects and too frequent changes | 2 |
| Age of teaching staff - if over 50 very resistant to change | 1 |
| Availability of suitably qualified staff to teach integrated subjects | 1 |
| Neighbourhood school | 1 |
| "Split" premises | 1 |
| Abandoning of streaming in years 1 and 2, banding years 3-5 | 1 |
| Availability of teacher recruits with radical "existential" or progressive personal philosophies | 1 |
| In-service training of teachers on advanced education type courses | 1 |
| Age of staff | 1 |
| | 30 |

## Section 9 Effects of curriculum projects

SOME OF THE POSSIBLE EFFECTS OF CURRICULUM RESEARCH AND DEVELOPMENT PROJECTS ARE LISTED BELOW. PLEASE INDICATE YOUR OPINION OF THEIR SIGNIFICANCE BY USE OF THE CODE TO THE RIGHT.

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 272 | improve the quality of pupils' school experience | 64 | 170 | 40 | 2 | 1 | 12 | 4.1 |
| 273 | support those teachers who are already attempting to bring about change in schools | 63 | 180 | 32 | 2 | 1 | 11 | 4.1 |
| 274 | over-emphasize the role of technical aids in teaching (e.g. programmed learning) | 15 | 71 | 82 | 95 | 10 | 16 | 3.0 |
| 275 | provide resources from which teachers may select | 69 | 190 | 17 | 2 | 0 | 11 | 4.2 |
| 276 | increase the burden of preparation for teachers | 73 | 151 | 31 | 21 | 2 | 11 | 4.0 |
| 277 | provide packages that can be fully adopted | 7 | 70 | 78 | 102 | 15 | 17 | 2.8 |
| 278 | promise more improvements than can reasonably be expected | 13 | 128 | 94 | 41 | 3 | 10 | 3.4 |
| 279 | introduce new methods of teaching into the schools | 47 | 197 | 26 | 6 | 2 | 11 | 4.0 |
| 280 | enable an atypical group to impose unrealistic standards for the rest of the schools' population | 7 | 38 | 91 | 116 | 19 | 18 | 2.6 |
| 281 | provide schemes for teaching based on the psychology of learning | 8 | 130 | 114 | 16 | 1 | 20 | 3.5 |
| 282 | promote dissatisfaction with what has been tested over time and shown to work | 5 | 49 | 81 | 129 | 8 | 17 | 2.7 |
| 283 | demonstrate how new subject matter may be introduced at school level | 22 | 230 | 21 | 2 | 1 | 13 | 4.0 |
| 284 | promote the use of behavioural objectives | 8 | 119 | 128 | 12 | 0 | 22 | 3.5 |
| 285 | widen the aims and objectives of teaching a subject | 48 | 196 | 21 | 10 | 1 | 13 | 4.0 |
| 286 | maintain specialist divisions between subjects | 0 | 14 | 54 | 176 | 29 | 16 | 2.2 |
| 287 | provide alternatives for schools programmes | 13 | 199 | 54 | 7 | 0 | 16 | 3.8 |
| 288 | support classification of children into ability groups | 2 | 27 | 74 | 150 | 21 | 15 | 2.4 |
| 289 | influence changes in external examinations | 21 | 161 | 67 | 22 | 3 | 15 | 3.6 |
| 290 | appeal to "band-wagon" participation by teachers | 39 | 106 | 64 | 61 | 6 | 13 | 3.4 |
| 291 | influence the internal organization of schools (time-tabling, streaming etc.) | 47 | 174 | 31 | 24 | 2 | 11 | 3.9 |
| 292 | provide a means of promoting personal status | 20 | 105 | 75 | 59 | 13 | 17 | 3.2 |

## Section 9 (contd.) Effects of curriculum projects

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 293 | discourage innovation because of the multiplicity of projects | 9 | 44 | 95 | 112 | 11 | 18 | 2.7 |
| 294 | encourage LEAs to provide improved facilities | 25 | 181 | 36 | 26 | 7 | 14 | 3.7 |
| 295 | provide idealists with a platform | 29 | 113 | 75 | 49 | 6 | 17 | 3.4 |
| 296 | increase outside support for change in schools | 9 | 103 | 104 | 43 | 8 | 22 | 3.2 |
| 297 | create feelings of inadequacy in teachers | 7 | 64 | 83 | 99 | 17 | 19 | 2.8 |
| 298 | support the influence of schools on local government education policy | 3 | 67 | 132 | 50 | 17 | 20 | 3.0 |
| 299 | introduce uniformity into school programmes | 0 | 23 | 49 | 166 | 32 | 19 | 2.2 |
| 300 | support the influence of schools on national government education policy | 3 | 46 | 132 | 68 | 18 | 22 | 2.8 |
| | Total | 676 | 3346 | 1981 | 1668 | 254 | 456 | |
| | % of total | 8.1 | 39.9 | 23.6 | 19.9 | 3.0 | 5.4 | |

CURRICULUM DIFFUSION RESEARCH PROJECT
Centre for Science Education,
Chelsea College, Bridges Place, S.W.6

## HEAD TEACHER QUESTIONNAIRE

25% sample -
N = 116

### Section 1. School information (please circle correct answer)

WHICH ONE OF THE FOLLOWING BEST DESCRIBES THE ABILITY RANGE OF PUPILS IN YOUR SCHOOL?

| | |
|---|---|
| 0 - no response | 1 |
| 1 - grammar or technical grammar | 17 |
| 2 - secondary modern | 40 |
| 3 - comprehensive with fully representative ability range for area | 37 |
| 4 - comprehensive but some (less than 10%) able pupils from area going to a grammar school | 11 |
| 5 - comprehensive but many (10% or over) of able pupils from area going to a grammar school | 10 |
| 6 - 6th form college | 0 |
| | 116 |

IF YOUR SCHOOL IS AT PRESENT UNDERGOING RE-ORGANIZATION (OR DID LAST YEAR OR WILL WITHIN THE NEXT 3 YEARS) PLEASE INDICATE THE TYPE OF CHANGE -

| | |
|---|---|
| 0 - no change | 42 |
| 1 - secondary modern to comprehensive | 40 |
| 2 - grammar to comprehensive | 15 |
| 3 - grammar and secondary modern to comprehensive | 4 |
| 4 - other: | 15 |
| | 116 |

WHAT IS THE AGE RANGE OF YOUR PUPILS?

| | |
|---|---|
| 0 | 0 |
| 1 - 11 to 13 | 1 |
| 2 - 11 to 14 | 8 |
| 3 - 11 to 16 | 44 |
| 4 - 11 to 18 | 52 |
| 5 - 13 to 16 | 0 |
| 6 - 13 to 18 | 3 |
| 7 - 16 to 18 | 0 |
| 8 - other | 8 |
| | 116 |

## Section 1 (contd.)

WHAT IS THE SEX OF PUPILS?

| | |
|---|---|
| 1 - boys | 14 |
| 2 - girls | 11 |
| 3 - mixed | 91 |
| | 116 |

HOW MANY PUPILS ARE THERE IN YOUR SCHOOL?

| | | |
|---|---|---|
| MEAN | | 751 |
| minimum | 251 | |
| maximum | 1825 | |

## Section 2. Individual information

### Variables 006 and 007:

HOW MANY YEARS HAVE YOU BEEN IN YOUR PRESENT SCHOOL AS A HEAD TEACHER?

HOW MANY YEARS IN ALL HAVE YOU BEEN A HEAD TEACHER?

| Years | Experience as head in present school | Total years as head teacher |
|---|---|---|
| 1 | 18 | 10 |
| 2 | 10 | 8 |
| 3 | 10 | 5 |
| 4 | 6 | 7 |
| 5 | 8 | 6 |
| 6 | 8 | 4 |
| 7 | 7 | 5 |
| 8 | 8 | 7 |
| 9 | 3 | 6 |
| 10 | 8 | 4 |
| 11 | 2 | 5 |
| 12 | 1 | 4 |
| 13 | 3 | 2 |
| 14 | 3 | 2 |
| 15 | 7 | 7 |
| 16 | 6 | 3 |
| 17 | - | 3 |
| 18 | 1 | 4 |
| 19 | 1 | 4 |
| 20 | 4 | 6 |
| 21 | 1 | 3 |
| 22 | - | 1 |
| 23 | 1 | 5 |
| 25 | - | 1 |
| 26 | - | 3 |

Recoded 006

| | Frequency | % |
|---|---|---|
| 1 - 3 | 38 | 33 |
| 4 - 8 | 37 | 32 |
| 9+ | 41 | 35 |

Recoded 007

| | Frequency | % |
|---|---|---|
| 1 - 6 | 40 | 35 |
| 7 - 14 | 35 | 30 |
| 15 - 26 | 41 | 35 |

Section 2 (Contd.)

IN WHAT SUBJECT AREA DID YOU OBTAIN YOUR QUALIFICATION AT COLLEGE OR UNIVERSITY -

| | |
|---|---|
| 1 - humanities | 61 |
| 2 - social sciences | 8 |
| 3 - science/technology | 18 |
| 4 - mathematics | 16 |
| 5 - other | 13 |
| | 116 |

DO YOU PRESENTLY TEACH IN YOUR SUBJECT AREA?

| | |
|---|---|
| 0 - no response | 0 |
| 1 - yes | 60 |
| 2 - no | 56 |
| | 116 |

## Section 3. Project influence

In my opinion the project materials have -

5 - considerable desirable effects
4 - some desirable effects
3 - no effects
2 - some undesirable effects
1 - considerable undesirable effects

| | | Mean rating of influence | Number of responses to each rating of influence | | | | | Total Responses |
|---|---|---|---|---|---|---|---|---|
| | | | 5 | 4 | 3 | 2 | 1 | |
| **Projects supported by Schools Council** | | | | | | | | |
| Environmental Studies | 010 | 3.7 | 2 | 22 | 11 | 0 | 1 | 36 |
| General Studies Project | 017 | 3.7 | 3 | 20 | 12 | 0 | 0 | 35 |
| Humanities Curriculum Project | 024 | 3.9 | 13 | 29 | 14 | 3 | 0 | 59 |
| Integrated Science (SCISP) | 031 | 3.8 | 10 | 9 | 11 | 3 | 0 | 33 |
| Keele Integrated Studies | 038 | 3.4 | 0 | 8 | 12 | 0 | 0 | 20 |
| Loughborough Engineering Sc. | 045 | 3.3 | 1 | 3 | 13 | 0 | 0 | 17 |
| Mathematics for the Majority | 052 | 3.7 | 2 | 18 | 13 | 0 | 0 | 33 |
| Mathematics for the Majority Continuation Project | 059 | 3.4 | 1 | 7 | 13 | 1 | 0 | 22 |
| Midlands Mathematics Experiment | 066 | 3.5 | 5 | 14 | 13 | 0 | 3 | 35 |
| Moral Education 13-16 | 073 | 3.6 | 4 | 10 | 12 | 1 | 0 | 27 |
| North-West Regional Curriculum Development Project | 080 | 3.1 | 1 | 2 | 12 | 0 | 1 | 16 |
| Project Environment | 087 | 3.1 | 0 | 1 | 10 | 0 | 0 | 11 |
| Project Technology | 094 | 3.7 | 4 | 17 | 11 | 0 | 1 | 33 |
| Science 5 - 13 | 101 | 3.6 | 1 | 10 | 10 | 0 | 0 | 21 |
| **Nuffield Projects** | | | | | | | | |
| O-level Biology | 108 | 4.2 | 20 | 28 | 11 | 0 | 0 | 59 |
| O-level Chemistry | 115 | 4.1 | 20 | 31 | 12 | 0 | 0 | 63 |
| O-level Physics | 122 | 4.1 | 17 | 34 | 11 | 0 | 0 | 62 |
| A-level Biological Science | 129 | 3.8 | 7 | 8 | 13 | 0 | 0 | 28 |
| A-level Chemistry | 136 | 3.9 | 7 | 11 | 11 | 0 | 0 | 29 |
| A-level Physics | 143 | 3.7 | 4 | 12 | 11 | 0 | 0 | 27 |
| A-level Physical Science | 150 | 3.4 | 2 | 6 | 12 | 1 | 0 | 21 |
| Combined Science | 157 | 4.2 | 21 | 19 | 10 | 0 | 0 | 50 |
| Secondary Science | 164 | 4.0 | 13 | 22 | 10 | 1 | 1 | 47 |
| Nuffield Mathematics | 171 | 3.5 | 3 | 16 | 14 | 1 | 1 | 35 |
| **Other** | | | | | | | | |
| Scottish Integrated Science | 178 | 3.8 | 6 | 6 | 12 | 0 | 0 | 24 |
| Total | | | 167 | 363 | 294 | 11 | 8 | 843 |
| | | | 19.8% | 43.1% | 34.9% | 1.3% | 0.9% | |

**Section 3 (contd.) Project familiarity**

Please tick .✓. in columns (B-G) after each curriculum project the statements which are correct in your case.
LEAVE SPACE BLANK IF YOU DO NOT KNOW.

I am aware of the following aspects of the project -

| | | (B) | (C) | (D) | (E) | (F) | (G) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Projects supported by Schools Council** | the project's existence | age and ability range | main objectives | main teaching methods | materials produced or planned | approx. cost of adoption | Total frequency | % of total |
| 011-016 | Environmental Studies | 66 | 31 | 32 | 19 | 15 | 12 | 175 | 4.2 |
| 018-023 | General Studies Project | 56 | 36 | 35 | 22 | 19 | 16 | 184 | 4.4 |
| 025-030 | Humanities Curriculum Project | 82 | 64 | 69 | 59 | 54 | 47 | 375 | 9.0 |
| 032-037 | Integrated Science (SCISP) | 53 | 34 | 34 | 23 | 19 | 14 | 177 | 4.2 |
| 039-044 | Keele Integrated Studies | 29 | 16 | 14 | 7 | 8 | 6 | 80 | 1.9 |
| 046-051 | Loughborough Engineering Scien | 19 | 8 | 9 | 4 | 3 | 2 | 45 | 1.1 |
| 053-058 | Mathematics for the Majority | 49 | 30 | 27 | 21 | 14 | 9 | 150 | 3.6 |
| 060-065 | Mathematics for the Majority Continuation Project | 26 | 16 | 15 | 12 | 10 | 8 | 87 | 2.1 |
| 067-072 | Midlands Mathematics Experiment | 55 | 34 | 31 | 21 | 17 | 14 | 172 | 4.1 |
| 074-079 | Moral Education 13-16 | 43 | 26 | 26 | 14 | 13 | 9 | 131 | 3.1 |
| 081-086 | North-West Regional Curriculum Development Project | 17 | 9 | 7 | 4 | 4 | 3 | 44 | 1.0 |
| 088-093 | Project Environment | 8 | 1 | 1 | 0 | 0 | 0 | 10 | 0.2 |
| 095-100 | Project Technology | 45 | 37 | 33 | 24 | 19 | 13 | 171 | 4.1 |
| 102-107 | Science 5-13 | 21 | 17 | 14 | 12 | 11 | 7 | 82 | 2.0 |
| | **Nuffield Projects** | | | | | | | | |
| 109-114 | O-level Biology | 77 | 57 | 52 | 45 | 41 | 41 | 313 | 7.5 |
| 116-121 | O-level Chemistry | 80 | 60 | 56 | 49 | 41 | 41 | 327 | 7.9 |
| 123-128 | O-level Physics | 80 | 61 | 57 | 50 | 45 | 43 | 336 | 8.1 |
| 130-135 | A-level Biological Science | 47 | 31 | 23 | 20 | 16 | 14 | 151 | 3.6 |
| 137-142 | A-level Chemistry | 46 | 29 | 20 | 17 | 11 | 10 | 133 | 3.2 |
| 144-149 | A-level Physics | 46 | 28 | 20 | 16 | 11 | 8 | 129 | 3.1 |
| 151-156 | A-level Physical Science | 41 | 23 | 16 | 12 | 7 | 6 | 105 | 2.5 |
| 158-163 | Combined Science | 66 | 52 | 47 | 44 | 39 | 35 | 283 | 6.8 |
| 165-170 | Secondary Science | 62 | 52 | 46 | 43 | 32 | 26 | 261 | 6.3 |
| 172-177 | Nuffield Mathematics | 55 | 34 | 27 | 18 | 15 | 11 | 160 | 3.8 |
| | **Other** | | | | | | | | |
| 179-184 | Scottish Integrated Science | 21 | 13 | 13 | 12 | 10 | 9 | 78 | 1.9 |
| | Total | 1190 | 799 | 724 | 568 | 474 | 404 | 4159 | |
| | % of total | 28.6 | 19.2 | 17.4 | 13.6 | 11.4 | 9.7 | | |

## Section 4 Involvement in projects

A Projects named whose materials are used fully or in part in the school. (Variables 185-195)

B Participation of school in trials of project (Variables 197-202)

**Total named as used** (196)

| | | | | | |
|---|---|---|---|---|---|
| 0 | 17 | 4 | 11 | 8 | 1 |
| 1 | 22 | 5 | 14 | 9 | 2 |
| 2 | 19 | 6 | 9 | | |
| 3 | 16 | 7 | 5 | | 116 |

**Total named for trial** (203)

| | | | | |
|---|---|---|---|---|
| 0 | 87 | 4 | 0 | |
| 1 | 19 | 5 | 0 | |
| 2 | 5 | 6 | 0 | |
| 3 | 3 | | | 116 |

| Projects supported by Schools Council | A | % of total named (N = 332) | % of total schools (N = 116) | B |
|---|---|---|---|---|
| Environmental Studies | 5 | 1.5 | 4.3 | 0 |
| General Studies Project | 12 | 3.6 | 10.3 | 1 |
| Humanities Curriculum Project | 33 | 9.9 | 28.4 | 3 |
| Integrated Science (SCISP) | 8 | 2.4 | 6.9 | 3 |
| Keele Integrated Studies | 2 | 0.6 | 1.7 | 1 |
| Loughborough Engineering Science | 2 | 0.6 | 1.7 | 1 |
| Mathematics for the Majority | 7 | 2.1 | 6.0 | 4 |
| Mathematics for the Majority Continuation Project | 3 | 0.9 | 2.6 | 0 |
| Midlands Mathematics Experiment | 10 | 3.0 | 8.6 | 1 |
| Moral Education 13 - 16 | 5 | 1.5 | 4.3 | 1 |
| North-West Regional Curriculum Development Project | 2 | 0.6 | 1.7 | 0 |
| Project Environment | 0 | 0.0 | 0.0 | 0 |
| Project Technology | 12 | 3.6 | 10.3 | 5 |
| Science 5-13 | 2 | 0.6 | 1.7 | 3 |
| **Nuffield Projects** | | | | |
| O-level Biology | 43 | 13.0 | 37.1 | 3 |
| O-level Chemistry | 41 | 12.0 | 35.3 | 2 |
| O-level Physics | 43 | 13.0 | 37.1 | 2 |
| A-level Biological Science | 12 | 3.6 | 10.3 | 2 |
| A-level Chemistry | 13 | 3.9 | 11.2 | 0 |
| A-level Physics | 9 | 2.7 | 7.8 | 0 |
| A-level Physical Science | 2 | 0.6 | 1.7 | 1 |
| Combined Science | 34 | 10.2 | 29.3 | 1 |
| Secondary Science | 20 | 6.0 | 17.2 | 4 |
| Nuffield Mathematics | 7 | 2.1 | 6.0 | 0 |
| **Other** | | | | |
| Scottish Integrated Science | 5 | 1.5 | 4.3 | 0 |
| | 332 | | | 38 |

## Section 4 Involvement in projects

### Projects named in addition to those listed on the questionnaire

| Project | No. of times named |
|---|---|
| Integrated study programme - team teaching | 2 |
| Non-exam option courses developed for ROSLA year | 1 |
| S.M.P. Maths | 13 |
| Nuffield French - en avant | 5 |
| Group Mode III CSE | 2 |
| Nuffield Spanish | 3 |
| Crédif French Project | 1 |
| Shropshire Maths Project | 2 |
| ROSLA Curriculum Development meeting in Salop | 1 |
| 16+ examination - pilot scheme for one exam | 1 |
| Cambridge Alternative C O-level syllabus | 1 |
| Environmental Studies - school syllabus | 2 |
| Humanities - school syllabus | 1 |
| Geography - 14-18 (Bristol) | 2 |
| Integrated Studies | 3 |
| Cambridge Latin Course | 3 |
| Lancaster Project | 1 |
| NUJMB Engineering Science | 1 |
| Work in Resource Centres | 1 |
| IDE (Curriculum Laboratory, Goldsmiths College, University of London) | 2 |
| Link courses with local Colleges of Advanced Technology | 1 |
| Geography for the Young School Leaver (Avery Hill College of Education, London) | 3 |
| Mixed Ability project - University of North Wales (Bangor) | 2 |
| O-level syllabuses | 1 |
| Scottish Maths Project | 1 |
| Shelter 3 part kit on Housing | 1 |
| Southampton Maths Project | 2 |
| MACOS "Man - A Course of Study" Bruner | 2 |
| JMB English Assessment at GCE O-level | 1 |
| Nuffield/S.C. German | 2 |
| LEA Projects | 1 |
| Local Educational Development Centre | 2 |
| Own "Thursday" Project 4th year - developing links with industry, commerce, government, religious bodies - with in and out visits | 1 |
| Mixed ability teaching, Integrated Studies, University of Essex | 1 |
| "Linked" courses (with Technical Colleges) for 14-16 year olds | 1 |
| New ideas in RE teaching and assemblies | 1 |
| ROSLA Computer Appreciation Course | 1 |
| NCC VI form computer appreciation package | 1 |
| ICL/CES 16 - Computer Studies | 1 |
| New Scottish Physics syllabus | 1 |
| New Scottish Chemistry syllabus | 1 |
| Local projects on Conservation and Environment organized by local organizations - Technical College, University, Conservation Societies | 1 |
| Locally organised projects organised in successive years on Curriculum Development in English | 1 |

## Section 4 (contd.) Involvement in projects

### Projects named in addition to those listed on the questionnaire

| Total no. named | Heads responding |
|---|---|
| 0 | 65 |
| 1 | 30 |
| 2 | 13 |
| 3 | 4 |
| 4 | 1 |
| 5 | 1 |

## Section 5 Future influences

IN YOUR OPINION, OF WHAT IMPORTANCE MAY THE FOLLOWING DEVELOPMENTS OR PROJECTS BE IN INFLUENCING FUTURE CHANGES IN THE CURRICULUM?

Please circle appropriate number.

| | | Considerable importance 4 | Some importance 3 | Little importance 2 | No importance 1 | No response 0 | Mean |
|---|---|---|---|---|---|---|---|
| 212 | Educational priority area projects (EPA) | 22 | 39 | 20 | 9 | 26 | 2.8 |
| 213 | comprehensive reorganization | 75 | 30 | 0 | 6 | 5 | 3.6 |
| 214 | raising of the school leaving age | 69 | 32 | 4 | 6 | 5 | 3.5 |
| 215 | reorganization of LEA boundaries | 13 | 32 | 35 | 25 | 11 | 2.3 |
| 216 | reorganization of teacher education | 33 | 43 | 23 | 6 | 11 | 3.0 |
| 217 | other | 16 | 3 | 0 | 0 | 96 | 3.8 |

## Section 6 Usefulness of information sources

Please circle the appropriate number in the columns below to indicate the extent to which you find the following sources of information about curriculum development projects useful -

| | | Very useful | Sometimes useful | Rarely useful | Never useful | No response | Mean |
|---|---|---|---|---|---|---|---|
| | **Impersonal sources** | 4 | 3 | 2 | 1 | 0 | |
| 222 | LEA circulars | 28 | 65 | 12 | 4 | 5 | 3.1 |
| 223 | DES memoranda and circulars | 28 | 65 | 14 | 1 | 6 | 3.1 |
| 224 | information direct from curriculum development projects | 54 | 44 | 8 | 0 | 8 | 3.4 |
| 225 | information from publishers | 7 | 60 | 37 | 3 | 7 | 2.7 |
| 226 | information from supply catalogues | 9 | 38 | 46 | 7 | 14 | 2.5 |
| 227 | 'Times Educational Supplement' | 14 | 66 | 21 | 4 | 9 | 2.9 |
| 228 | Schools Council 'Dialogue' | 46 | 48 | 15 | 2 | 3 | 3.2 |
| 229 | Schools Council Project Profiles and Index | 24 | 51 | 17 | 3 | 19 | 3.0 |
| 230 | other Schools Council publications | 23 | 56 | 15 | 5 | 15 | 3.0 |
| 231 | specialist subject journals | 19 | 46 | 27 | 7 | 15 | 2.8 |
| 232 | other educational journals | 2 | 60 | 27 | 8 | 17 | 2.6 |
| 233 | BBC T.V. educational programmes | 21 | 53 | 21 | 10 | 9 | 2.8 |
| | **Personal sources** | | | | | | |
| 234 | head of departments in your school | 66 | 40 | 2 | 2 | 4 | 3.5 |
| 235 | assistant teachers in your school | 31 | 60 | 11 | 3 | 9 | 3.1 |
| 236 | teachers from other schools | 10 | 64 | 25 | 6 | 9 | 2.7 |
| 237 | staff from schools participating in the trials of a curriculum project | 28 | 33 | 21 | 12 | 20 | 2.8 |
| 238 | head teachers | 19 | 64 | 17 | 2 | 12 | 3.0 |
| 239 | LEA advisers/inspectors | 33 | 55 | 20 | 2 | 4 | 3.1 |
| 240 | Schools Council field officers | 7 | 29 | 26 | 22 | 30 | 2.2 |
| 241 | HMIs | 19 | 52 | 27 | 7 | 9 | 2.8 |
| 242 | university lecturers | 0 | 22 | 31 | 41 | 20 | 1.8 |
| 243 | colleges of education lecturers | 1 | 25 | 39 | 34 | 15 | 1.9 |
| 244 | school governors | 1 | 10 | 24 | 67 | 12 | 1.5 |
| 245 | parents | 2 | 12 | 35 | 53 | 12 | 1.6 |
| | Total | 492 | 1119 | 538 | 305 | 283 | |
| | % of total response | 18.0 | 40.9 | 19.7 | 11.1 | 10.3 | |

## Section 7 Ranking of information sources

Would you please rank up to four of all the sources listed in Section 6 in terms of relative usefulness. Take into consideration both impersonal and personal sources.

| | | | Weighted mean response |
|---|---|---|---|
| Var. 246 | 1 most useful | Head of departments in your school | 3.5 |
| Var. 247 | 2 second most useful | Information direct from curriculum development projects | 3.2 |
| Var. 248 | 3 third most useful | LEA circulars | 2.5 |
| Var. 249 | 4 fourth most useful | Schools Council 'Dialogue' / LEA advisers/inspectors | 2.4/<br>2.3 |

| | No. of times mentioned in 246 - 249 | | | | |
|---|---|---|---|---|---|
| **Impersonal sources** | 1st | 2nd | 3rd | 4th | Total |
| LEA circulars | 8 | 1 | 5 | 7 | 21 |
| DES memoranda and circulars | 3 | 6 | 5 | 7 | 21 |
| information direct from curriculum development projects | 21 | 13 | 10 | 4 | 48 |
| information from publishers | - | 2 | 2 | 5 | 9 |
| information from supply catalogues | - | 2 | - | 2 | 4 |
| 'Times Educational Supplement' | 3 | 3 | 7 | 6 | 18 |
| Schools Council 'Dialogue' | 14 | 9 | 9 | 14 | 46 |
| Schools Council Project Profiles and Index | - | 4 | 8 | 5 | 17 |
| other Schools Council publications | 2 | 3 | 2 | - | 7 |
| specialist subject journals | 3 | 3 | 3 | 6 | 15 |
| other educational journals | - | - | - | 2 | 2 |
| BBC T.V. educational programmes | 4 | 3 | 4 | 4 | 15 |
| **Personal sources** | | | | | |
| head of departments in your school | 28 | 15 | 11 | 6 | 53 |
| assistant teachers in your school | 1 | 11 | 2 | 9 | 23 |
| teachers from other schools | - | 3 | 5 | - | 8 |
| staff from schools participating in the trials of a curriculum project | 6 | 5 | 4 | 3 | 18 |
| head teachers | 1 | 6 | 2 | 2 | 11 |
| LEA advisers/inspectors | 7 | 10 | 17 | 8 | 42 |
| Schools Council field officers | - | - | - | 2 | 2 |
| HMIs | 3 | 5 | 3 | 2 | 13 |
| university lecturers | - | - | - | - | - |
| colleges of education lecturers | - | - | 1 | 2 | 3 |
| school governors | - | - | - | - | - |
| parents | 1 | - | - | - | 1 |

## Section 8 Facilitating and limiting factors relating to your own school

The following list is of factors that may facilitate or limit the taking up of curriculum project materials and ideas.

Please circle the one number after each factor to indicate the extent of influence in your school.

| | | strongly facilitate 5 | moderately facilitate 4 | no effect 3 | moderately limit 2 | strongly limit 1 | no response 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 250 | qualifications of teaching staff | 24 | 36 | 29 | 13 | 3 | 9 | 3.6 |
| 251 | staff turnover | 4 | 7 | 51 | 38 | 8 | 6 | 2.6 |
| 252 | staff overworked | 5 | 6 | 43 | 43 | 12 | 5 | 2.5 |
| 253 | pastoral care of pupils | 10 | 17 | 55 | 20 | 5 | 7 | 3.1 |
| 254 | materials produced for a restricted ability range | 5 | 26 | 32 | 32 | 7 | 12 | 2.9 |
| 255 | university entry requirements | 2 | 5 | 70 | 22 | 5 | 10 | 2.8 |
| 256 | availability of CSE Mode 3 | 23 | 23 | 48 | 10 | 4 | 6 | 3.5 |
| 257 | provisions of special examinations relating to the project | 5 | 29 | 50 | 10 | 2 | 18 | 3.3 |
| 258 | availability of report on project evaluation | 10 | 26 | 48 | 12 | 3 | 15 | 3.3 |
| 259 | availability of money to launch projects | 22 | 15 | 3 | 34 | 36 | 4 | 2.6 |
| 260 | availability of money to maintain projects | 17 | 18 | 3 | 40 | 32 | 4 | 2.5 |
| 261 | adequate accommodation in school | 12 | 16 | 19 | 34 | 29 | 4 | 2.5 |
| 262 | use of school for student teaching practice | 2 | 13 | 69 | 18 | 4 | 8 | 2.9 |
| 263 | active teachers' centre in area | 17 | 45 | 32 | 7 | 3 | 10 | 3.6 |
| 264 | contacts between schools in area | 6 | 61 | 33 | 2 | 3 | 9 | 3.6 |
| 265 | LEA initiative in innovation | 32 | 44 | 23 | 5 | 2 | 8 | 3.9 |
| 266 | LEA advisory service | 27 | 54 | 22 | 2 | 2 | 7 | 4.0 |
| 267 | school planning for secondary reorganization | 8 | 26 | 44 | 16 | 9 | 11 | 3.1 |
| 268 | influence of secondary reorganization of the school curricula | 10 | 33 | 35 | 17 | 10 | 9 | 3.1 |
| 269 | influence of secondary reorganization on communication with other schools | 6 | 30 | 61 | 4 | 3 | 10 | 3.3 |
| 270 | uncertainty about school reorganization | 0 | 3 | 67 | 13 | 17 | 14 | 2.6 |
| 271 | others (please specify) | 3 | 1 | - | 3 | 13 | 94 | 1.9 |
| | Total | 250 | 534 | 838 | 392 | 210 | 284 | |
| | % of total | 10.0 | 21.3 | 33.4 | 15.6 | 8.4 | 11.3 | |

## Section 8 (contd.) Facilitating and limiting factors relating to your own school

### Factors named in addition to those listed on the questionnaire

| | No. of times named |
|---|---|
| Rapid growth of numbers and curriculum | 1 |
| Professional commitment of teaching staff | 1 |
| Size of staffroom and flexibility | 1 |
| Staff structure - lack of points for senior post | 1 |
| ROSLA | 1 |
| Time a limiting factor | 1 |
| Internal history of school | 1 |
| Parochial attitude of staff - insistence on keeping own subject teaching time in case of CSE exams. To encourage them to integrate subjects is a slow process. Young teachers are more willing to experiment with new methods. This is an old school with rapidly deteriorating housing etc., discipline is difficult. | 1 |
| Reluctance of staff to change | 1 |
| Failure of sense of purpose and lead in project organisers | 1 |
| Suitable open-minded heads of departments | 1 |
| Conservatism and specialism of older teaching staff | 1 |
| Too many projects flooding schools | 1 |
| Two sites - 1½ miles apart with 1:7 gradient and heavy traffic and outward junctions and corners | 1 |
| Experience of teaching staff | 1 |
| Difficulty of attracting more experienced staff due to housing costs | 1 |
| Attitude of parents - very pro-trad exams | 1 |
| Possibilities/facilities for in-service training | 1 |
| Inertia | 1 |
| Change of school at 14+ | 1 |
| | 20 |

## Section 9 Effects of curriculum projects

SOME OF THE POSSIBLE EFFECTS OF CURRICULUM RESEARCH AND DEVELOPMENT PROJECTS ARE LISTED BELOW. PLEASE INDICATE YOUR OPINION OF THEIR SIGNIFICANCE BY USE OF THE CODE TO THE RIGHT.

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 272 | improve the quality of pupils' school experience | 24 | 69 | 17 | 2 | 0 | 2 | 4.0 |
| 273 | support those teachers who are already attempting to bring about change in schools | 25 | 75 | 9 | 0 | 0 | 5 | 4.2 |
| 274 | over-emphasize the role of technical aids in teaching (e.g. programmed learning) | 6 | 21 | 44 | 34 | 3 | 6 | 2.9 |
| 275 | provide resources from which teachers may select | 24 | 77 | 9 | 0 | 0 | 4 | 4.2 |
| 276 | increase the burden of preparation for teachers | 35 | 53 | 14 | 7 | 0 | 6 | 4.1 |
| 277 | provide packages that can be fully adopted | 5 | 31 | 36 | 33 | 5 | 4 | 3.0 |
| 278 | promise more improvements than can reasonably be expected | 4 | 37 | 48 | 18 | 1 | 6 | 3.2 |
| 279 | introduce new methods of teaching into the schools | 18 | 77 | 11 | 6 | 0 | 2 | 4.0 |
| 280 | enable an atypical group to impose unrealistic standards for the rest of the schools' population | 3 | 16 | 36 | 47 | 6 | 6 | 2.7 |
| 281 | provide schemes for teaching based on the psychology of learning | 2 | 50 | 50 | 4 | 2 | 6 | 3.4 |
| 282 | promote dissatisfaction with what has been tested over time and shown to work | 4 | 21 | 33 | 49 | 3 | 4 | 2.7 |
| 283 | demonstrate how new subject matter may be introduced at school level | 8 | 95 | 6 | 2 | 0 | 3 | 4.0 |
| 284 | promote the use of behavioural objectives | 0 | 32 | 67 | 5 | 0 | 10 | 3.3 |
| 285 | widen the aims and objectives of teaching a subject | 10 | 85 | 11 | 4 | 0 | 4 | 3.9 |
| 286 | maintain specialist divisions between subjects | 1 | 10 | 15 | 75 | 7 | 6 | 2.3 |
| 287 | provide alternatives for schools programmes | 5 | 77 | 21 | 6 | 0 | 5 | 3.7 |
| 288 | support classification of children into ability groups | 1 | 11 | 34 | 56 | 7 | 5 | 2.5 |
| 289 | influence changes in external examinations | 5 | 72 | 25 | 7 | 0 | 5 | 3.7 |
| 290 | appeal to "band-wagon" participation by teachers | 12 | 42 | 30 | 23 | 3 | 4 | 3.3 |

## Section 9 (contd.) Effects of curriculum projects

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 291 | influence the internal organization of schools (time-tabling, streaming, etc.) | 16 | 71 | 8 | 13 | 1 | 5 | 3.8 |
| 292 | provide a means of promoting personal status | 6 | 39 | 35 | 20 | 5 | 9 | 3.2 |
| 293 | discourage innovation because of the multiplicity of projects | 4 | 15 | 41 | 42 | 3 | 9 | 2.7 |
| 294 | encourage LEAs to provide improved facilities | 9 | 70 | 23 | 8 | 0 | 4 | 3.7 |
| 295 | provide idealists with a platform | 7 | 51 | 35 | 14 | 2 | 5 | 3.4 |
| 296 | increase outside support for change in schools | 1 | 42 | 42 | 21 | 2 | 6 | 3.2 |
| 297 | create feelings of inadequacy in teachers | 7 | 28 | 40 | 32 | 2 | 5 | 3.0 |
| 298 | support the influence of schools on local government education policy | 0 | 20 | 57 | 28 | 4 | 5 | 2.8 |
| 299 | introduce uniformity into school programmes | 2 | 7 | 26 | 59 | 14 | 6 | 2.3 |
| 300 | support the influence of schools on national government education policy | 1 | 18 | 61 | 20 | 6 | 8 | 2.9 |
| | Total | 245 | 1312 | 884 | 635 | 76 | 154 | |
| | % of total | 7.4 | 39.7 | 26.7 | 19.2 | 2.3 | 4.7 | |

CURRICULUM DIFFUSION RESEARCH PROJECT
Centre for Science Education
Chelsea College, Bridges Place, S.W.6.

## TEACHER QUESTIONNAIRE

N = 433

### Section 1. Information

(for each item please select the number which best answers the question for you and enter in the box to the right)

WHAT IS YOUR APPOINTMENT?

| | Frequency (N) |
|---|---|
| 0 - no response | 9 |
| 1 - head of science department | 94 |
| 2 - head of biology, chemistry or physics | 97 |
| 3 - assistant teacher | 194 |
| 4 - other (please specify) | 39 |
| | 433 |

WHAT WAS YOUR TRAINING?

| | Frequency (N) |
|---|---|
| 0 - no response | 8 |
| 1 - teacher's certificate | 123 |
| 2 - degree or degree equivalent | 56 |
| 3 - degree + graduate certificate in education | 200 |
| 4 - higher degree | 17 |
| 5 - higher degree + graduate certificate in education | 12 |
| 6 - other (please specify) | 17 |
| | 433 |

WHAT IS THE MAIN SUBJECT YOU TEACH?

| | Frequency (N) |
|---|---|
| 0 - no response | 3 |
| 1 - Biology | 123 |
| 2 - Chemistry | 120 |
| 3 - Physics | 124 |
| 4 - General Science | 41 |
| 5 - Integrated Science | 6 |
| 6 - Physical Education | 1 |
| 7 - Mathematics | 6 |
| 8 - Combined Science | 8 |
| | 433 |

## Section 1 (contd.)

### Variables 004 to 009

Number of periods in one week taught to (a) specialist science subjects, (b) general, integrated or combined science and (c) subjects other than science.

| No. of periods | Frequency (a) Non-examination | (a) CSE | (a) O-level | (a) A-level | (b) General | (c) Other |
|---|---|---|---|---|---|---|
| 0 | 217 | 168 | 116 | 195 | 152 | 276 |
| 1 | 3 | | 1 | | 3 | 22 |
| 2 | 27 | 18 | 5 | 15 | 14 | 38 |
| 3 | 14 | 8 | 8 | 4 | 15 | 19 |
| 4 | 34 | 55 | 70 | 13 | 36 | 25 |
| 5 | 9 | 25 | 30 | 7 | 11 | 9 |
| 6 | 21 | 26 | 19 | 17 | 26 | 8 |
| 7 | 6 | 7 | 8 | 15 | 4 | 5 |
| 8 | 18 | 34 | 39 | 39 | 16 | 2 |
| 9 | 4 | 7 | 17 | 9 | 8 | 3 |
| 10 | 16 | 28 | 36 | 15 | 17 | 7 |
| 11 | 5 | 6 | 11 | 13 | 6 | 1 |
| 12 | 13 | 21 | 17 | 16 | 15 | 1 |
| 13 | 4 | 1 | 7 | 10 | 5 | 3 |
| 14 | 4 | 4 | 12 | 18 | 12 | |
| 15 | 2 | 4 | 4 | 7 | 8 | 1 |
| 16 | 8 | 6 | 8 | 20 | 9 | 1 |
| 17 | 3 | 4 | 3 | 4 | 5 | 1 |
| 18 | 4 | 4 | 6 | 5 | 12 | |
| 19 | 1 | | 2 | 3 | 3 | 1 |
| 20 | 9 | 2 | 6 | 3 | 7 | 1 |
| 21 | | 1 | | 1 | 3 | 1 |
| 22 | | | | 2 | 7 | |
| 23 | 21-41 12 | 24-39 5 | 22-42 8 | | 5 | 24-32 8 |
| 24 | | | | 2 | 9 | |
| 26 | | | | | 1 | |
| 27 | | | | | 1 | |
| 28 | | | | | 1 | |
| 29 | | | | | 3 | |
| 30 | | | | | 9 | |
| 31 | | | | | 1 | |
| 33 | | | | | 2 | |
| 34 | | | | | 1 | |
| 35 | | | | | 3 | |
| 36 | | | | | 2 | |

| | Mean |
|---|---|
| HOW MANY YEARS OF FULL-TIME TEACHING HAVE YOU COMPLETED? | 9.2 |
| HOW MANY YEARS HAVE YOU COMPLETED IN YOUR PRESENT SCHOOL? | 5.1 |
| IN HOW MANY SECONDARY SCHOOLS HAVE YOU PREVIOUSLY TAUGHT? | 1.4 |
| HOW MANY YEARS HAVE YOU COMPLETED WITH YOUR PRESENT LEA? | 6.6 |

Section 1 (contd.)

Computed variables derived from 004 to 008

Ratio values for sub-dividing teachers into percentage groups.

| Percentage | Categories | | | | |
|---|---|---|---|---|---|
| | PNEX | PCSE | POLE | PALE | PGEN |
| 33 | - | - | .12 | - | - |
| 50 | - | .13 | .18 | .12 | .16 |
| 66 | .14 | .20 | .29 | .26 | .32 |
| 75 | .22 | .26 | .32 | .33 | .41 |
| Group Mean | .13 | .15 | .21 | .19 | .25 |

The percentage of teachers not teaching any periods in the five categories are - 50%, 39%, 27%, 45%, 35% respectively. Thus half of the teachers are below the 50th percentil for PNEX. The only categories in which teachers can be divided into thirds is POLE. For the remaining four categories teachers may only be divided into two equal sub-groups.

Section 1 (contd.)

Variables 004 to 009

Total teaching periods

| No. of periods | Frequency | Cumulative frequency (percentage) |
|---|---|---|
| 0 | 1 | 0.2 |
| 8 | 3 | 0.9 |
| 9 | 1 | 1.2 |
| 10 | 5 | 2.3 |
| 11 | 2 | 2.8 |
| 12 | 3 | 3.5 |
| 14 | 3 | 4.2 |
| 15 | 2 | 4.6 |
| 16 | 6 | 6.0 |
| 17 | 4 | 6.9 |
| 18 | 3 | 7.6 |
| 19 | 3 | 8.3 |
| 20 | 10 | 10.3 |
| 21 | 5 | 11.8 |
| 22 | 8 | 13.6 |
| 23 | 5 | 14.8 |
| 24 | 12 | 17.6 |
| 25 | 13 | 20.6 |
| 26 | 18 | 24.7 |
| 27 | 6 | 26.1 |
| 28 | 25 | 31.9 |
| 29 | 21 | 36.7 |
| 30 | 45 | 47.1 |
| 31 | 26 | 53.1 |
| 32 | 47 | 64.0 |
| 33 | 22 | 69.1 |
| 34 | 35 | 77.1 |
| 35 | 19 | 81.5 |
| 36 | 19 | 85.9 |
| 37 | 7 | 87.5 |
| 38 | 9 | 89.6 |
| 39 | 4 | 90.5 |
| 40 | 4 | 91.5 |
| 41 | 2 | 91.9 |
| 42 | 2 | 92.4 |
| 44 | 3 | 93.1 |
| 45 | 5 | 94.2 |
| 46 | 1 | 94.5 |
| 48 | 3 | 95.2 |
| 50 | 5 | 96.3 |
| 51 | 1 | 96.5 |
| 52 | 1 | 96.8 |
| 53 | 1 | 97.0 |
| 54 | 4 | 97.9 |
| 56 | 2 | 98.4 |
| 57 | 1 | 98.6 |
| 58 | 2 | 99.1 |
| 60 | 2 | 99.5 |
| 64 | 1 | 99.8 |
| 70 | 1 | 100.0 |

| | |
|---|---|
| Mean | 30.8 |
| Mode | 32.0 |
| Kurtosis | 2.55 |
| Std. Error | 0.43 |
| Std. Deviation | 8.96 |
| Skewness | 0.50 |
| Median | 30.98 |
| Variance | 80.18 |
| Range | 70.00 |

## Section 2. Curriculum Development Projects

PLEASE INDICATE THE EXTENT TO WHICH YOU ARE
(a) FAMILIAR WITH

1 - not familiar
2 - read about or heard of project
3 - read a few of the materials
4 - read most of the materials

| | Recoded values | 0 | 0 | 1 | 2 | 3 | Recoded Mean |
|---|---|---|---|---|---|---|---|
| | Original values | 0 | 1 | 2 | 3 | 4 | |
| **Nuffield Projects** | | | | | | | |
| O-level Biology | 14 | 33 | 88 | 67 | 112 | 133 | 1.6 |
| O-level Chemistry | 16 | 37 | 86 | 70 | 96 | 144 | 1.6 |
| O-level Physics | 18 | 33 | 76 | 73 | 109 | 142 | 1.7 |
| A-level Biological Science | 20 | 43 | 207 | 93 | 49 | 41 | 0.7 |
| A-level Chemistry | 22 | 44 | 182 | 93 | 45 | 69 | 0.9 |
| A-level Physics | 24 | 45 | 187 | 108 | 62 | 31 | 0.8 |
| A-level Physical Science | 26 | 48 | 215 | 113 | 47 | 10 | 0.5 |
| Combined Science | 28 | 32 | 47 | 71 | 107 | 177 | 1.9 |
| Secondary Science | 30 | 33 | 67 | 83 | 130 | 120 | 1.6 |
| **Projects supported by Schools Council** | | | | | | | |
| Integrated Science Project (SCISP) | 32 | 36 | 168 | 143 | 65 | 21 | 0.8 |
| Science 5-13 | 34 | 41 | 221 | 107 | 52 | 12 | 0.6 |
| Project Technology | 36 | 41 | 230 | 84 | 61 | 17 | 0.6 |
| Loughborough Engineering Science | 38 | 42 | 358 | 26 | 5 | 2 | 0.1 |
| Keele Integrated Studies | 40 | 42 | 368 | 21 | 1 | 1 | 0.1 |
| Environmental Studies | 42 | 42 | 283 | 84 | 21 | 3 | 0.3 |
| Project Environment | 44 | 42 | 347 | 35 | 9 | - | 0.1 |
| **Others** | | | | | | | |
| Scottish Integrated Science | 46 | 42 | 190 | 85 | 72 | 44 | 0.8 |
| Your School or LEA project | 48 | 227 | 168 | 4 | 5 | 29 | 0.2 |

Section 2 (Contd.)

PLEASE INDICATE THE EXTENT TO WHICH YOU

(b) USE (by yourself)

1 - do not use
2 - using ideas from project but not the materials at present
3 - less than ⅓ of the materials used at present
4 - more than ⅓ but less than ⅔ of the materials used at present
5 - all or most of the materials used at present

| | | 0 | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|---|---|
| Nuffield Projects | | | | | | | | |
| O-level Biology | 15 | 38 | 221 | 54 | 50 | 38 | 32 | 1.8 |
| O-level Chemistry | 17 | 39 | 218 | 47 | 35 | 50 | 44 | 1.9 |
| O-level Physics | 19 | 38 | 209 | 49 | 60 | 36 | 41 | 1.9 |
| A-level Biological Science | 21 | 51 | 336 | 22 | 10 | 5 | 9 | 1.1 |
| A-level Chemistry | 23 | 49 | 300 | 34 | 12 | 8 | 31 | 1.4 |
| A-level Physics | 25 | 51 | 347 | 17 | 10 | - | 8 | 1.0 |
| A-level Physical Science | 27 | 56 | 364 | 4 | 5 | - | 3 | 0.9 |
| Combined Science | 29 | 37 | 183 | 52 | 36 | 39 | 86 | 2.3 |
| Secondary Science | 31 | 39 | 211 | 84 | 46 | 25 | 28 | 1.7 |
| Projects supported by Schools Council | | | | | | | | |
| Integrated Science Project (SCISP) | 33 | 43 | 361 | 20 | - | 1 | 8 | 1.0 |
| Science 5-13 | 35 | 45 | 355 | 26 | 5 | - | 2 | 1.0 |
| Project Technology | 37 | 51 | 349 | 27 | 2 | 2 | 2 | 1.0 |
| Loughborough Engineering Science | 39 | 51 | 377 | 3 | 1 | - | 1 | 0.9 |
| Keele Integrated Studies | 41 | 52 | 380 | 1 | - | - | - | 0.9 |
| Environmental Studies | 43 | 53 | 363 | 13 | 4 | - | - | 0.9 |
| Project Environment | 45 | 52 | 374 | 7 | - | - | - | 0.9 |
| Others | | | | | | | | |
| Scottish Integrated Science | 47 | 47 | 309 | 57 | 11 | 1 | 8 | 1.2 |
| Your School or LEA project | 49 | 223 | 189 | 2 | 4 | 2 | 13 | 0.6 |

## Section 3. Facilitating and limiting factors relating to use of specified projects

(a) most familiar or used

Please select from the code on the right the number that represents the extent you feel the following factors limit or facilitate use of the projects you have named after (a) and (b) above.

5 - strongly facilitating
4 - facilitating
3 - no influence
2 - limiting
1 - strongly limiting

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean* |
|---|---|---|---|---|---|---|---|---|
| rate of turnover of teaching staff | 55 | 5 | 19 | 223 | 114 | 22 | 50 | 2.7 |
| time available for preparation | 57 | 14 | 23 | 71 | 192 | 90 | 43 | 2.2 |
| availability of special grants to start project | 59 | 73 | 93 | 45 | 97 | 78 | 47 | 3.0 |
| availability of money to keep project going | 61 | 32 | 86 | 63 | 127 | 74 | 51 | 2.7 |
| accommodation available | 63 | 19 | 62 | 83 | 139 | 84 | 46 | 2.5 |
| effects of secondary re-organization | 65 | 14 | 46 | 193 | 78 | 49 | 53 | 2.7 |
| school organization | 67 | 17 | 52 | 176 | 107 | 35 | 46 | 2.8 |
| requirements of external examinations | 69 | 15 | 49 | 183 | 109 | 31 | 46 | 2.8 |
| flexibility of use of project materials | 71 | 30 | 158 | 135 | 45 | 11 | 54 | 3.4 |
| availability of Mode 3 CSE | 73 | 32 | 70 | 249 | 18 | 6 | 58 | 3.3 |
| ability and age range of pupils | 75 | 26 | 76 | 94 | 144 | 45 | 48 | 2.7 |
| availability of technicians | 77 | 47 | 72 | 52 | 128 | 88 | 46 | 2.6 |
| developments related to raising the school leaving age | 79 | 6 | 42 | 282 | 33 | 15 | 55 | 3.0 |
| attitude of colleagues in your school | 81 | 34 | 108 | 188 | 43 | 12 | 48 | 3.3 |
| activity of LEA teachers' centre | 83 | 16 | 111 | 232 | 8 | 9 | 57 | 3.3 |
| activity of other institutions | 85 | 10 | 89 | 254 | 9 | 7 | 64 | 3.2 |
| support by LEA for attending courses | 87 | 39 | 187 | 125 | 20 | 9 | 53 | 3.6 |
| activities of LEA advisory service | 89 | 20 | 101 | 230 | 16 | 10 | 56 | 3.3 |
| availability of information about curriculum project | 91 | 71 | 177 | 91 | 29 | 8 | 57 | 3.7 |
| contacts with trial schools involved in project | 93 | 27 | 97 | 207 | 31 | 19 | 52 | 3.2 |
| similarity of content or methods in the project with previous teaching | 95 | 19 | 177 | 147 | 30 | 5 | 55 | 3.5 |
| objectives of project | 97 | 62 | 202 | 86 | 23 | 6 | 54 | 3.8 |
| provision of special examinations related to the project | 99 | 47 | 112 | 183 | 33 | 6 | 52 | 3.4 |
| pupil's need for a formal qualification | 101 | 18 | 53 | 197 | 83 | 31 | 51 | 2.9 |
| your pre-service education at college or university | 103 | 44 | 108 | 162 | 50 | 20 | 49 | 3.3 |
| other | 105 | 11 | 5 | 19 | 5 | 9 | 384 | 3.1 |

* 0 excluded

## Section 3. Facilitating and limiting factors relating to use of specified projects

(b) least useful or rejected

Please select from the code on the right the number that represents the extent you feel the following factors limit or facilitate use of the projects you have named after (a) and (b) above.

5 - strongly facilitating
4 - facilitating
3 - no influence
2 - limiting
1 - strongly limiting

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean* |
|---|---|---|---|---|---|---|---|---|
| rate of turnover of teaching staff | 56 | 2 | 3 | 116 | 41 | 24 | 247 | 2.6 |
| time available for preparation | 58 | 5 | 4 | 58 | 57 | 60 | 249 | 2.1 |
| availability of special grants to start project | 60 | 13 | 22 | 66 | 37 | 47 | 248 | 2.6 |
| availability of money to keep project going | 62 | 9 | 14 | 68 | 53 | 40 | 249 | 2.4 |
| accommodation available | 64 | 5 | 9 | 63 | 54 | 56 | 246 | 2.2 |
| effects of secondary re-organization | 66 | 2 | 15 | 101 | 27 | 39 | 249 | 2.5 |
| school organization | 68 | 2 | 11 | 80 | 42 | 52 | 246 | 2.3 |
| requirements of external examinations | 70 | 3 | 11 | 86 | 50 | 35 | 248 | 2.4 |
| flexibility of use of project materials | 72 | 5 | 44 | 86 | 38 | 10 | 250 | 3.0 |
| availability of Mode 3 CSE | 74 | 10 | 18 | 130 | 11 | 12 | 252 | 3.0 |
| ability and age range of pupils | 76 | 7 | 20 | 52 | 49 | 57 | 248 | 2.3 |
| availability of technicians | 78 | 10 | 17 | 46 | 55 | 57 | 248 | 2.3 |
| developments related to raising the school leaving age | 80 | 2 | 19 | 126 | 21 | 13 | 252 | 2.9 |
| attitude of colleagues in your school | 82 | 4 | 17 | 95 | 46 | 21 | 250 | 2.7 |
| activity of LEA teachers' centre | 84 | 2 | 31 | 132 | 8 | 9 | 251 | 3.0 |
| activity of other institutions | 86 | 4 | 16 | 144 | 7 | 8 | 254 | 3.0 |
| support by LEA for attending courses | 88 | 7 | 61 | 89 | 15 | 10 | 251 | 3.2 |
| activities of LEA advisory service | 90 | 3 | 33 | 125 | 13 | 8 | 251 | 3.1 |
| availability of information about curriculum project | 92 | 12 | 56 | 68 | 34 | 13 | 250 | 3.1 |
| contacts with trial schools involved in project | 94 | 8 | 24 | 98 | 30 | 23 | 250 | 2.8 |
| similarity of content or methods in the project with previous teaching | 96 | 5 | 31 | 86 | 38 | 21 | 252 | 2.8 |
| objectives of project | 98 | 12 | 45 | 61 | 41 | 25 | 249 | 2.9 |
| provision of special examinations related to the project | 100 | 8 | 20 | 108 | 28 | 18 | 251 | 2.8 |
| pupil's need for a formal qualification | 102 | 3 | 14 | 94 | 45 | 27 | 250 | 2.6 |
| your pre-service education at college or university | 104 | 8 | 15 | 103 | 28 | 28 | 251 | 2.7 |
| other | 106 | 2 | - | 15 | 2 | 16 | 398 | 2.1 |

* 0 excluded

## Section 3. Facilitating and limiting factors relating to the use of specified projects.

(Variables 050, 051)

(a) PLEASE NAME A CURRICULUM PROJECT WITH WHICH YOU ARE MOST FAMILIAR OR USE MOST -

(b) PLEASE NAME A CURRICULUM PROJECT WHICH YOU FIND LEAST USEFUL OR HAVE REJECTED -

| | (a) | % of total N=433 | (b) | % of total N=433 |
|---|---|---|---|---|
| Nuffield Projects - | | | | |
| O-level Biology | 78 | 18 | 17 | 4 |
| O-level Chemistry | 85 | 20 | 6 | 1 |
| O-level Physics | 77 | 18 | 11 | 2 |
| A-level Biological Science | 8 | 2 | 8 | 2 |
| A-level Chemistry | 20 | 5 | 4 | 1 |
| A-level Physics | 2 | >1 | 1 | |
| A-level Physical Science | 3 | >1 | 12 | 3 |
| Combined Science | 91 | 21 | 24 | 6 |
| Secondary Science | 21 | 5 | 25 | 6 |
| Projects supported by Schools Council | | | | |
| Integrated Science Project (SCISP) | 5 | 1 | 30 | 7 |
| Science 5-13 | 5 | 1 | 11 | 2 |
| Project Technology | 2 | >1 | 15 | 4 |
| Loughborough Engineering Science | 2 | >1 | 2 | |
| Keele Integrated Studies | 0 | | 3 | 1 |
| Environmental Studies | 0 | | | |
| Project Environment | 1 | | 1 | |
| Others - | | | | |
| Scottish Integrated Science | 4 | 1 | 11 | 2 |
| Your School or LEA project | 1 | | 1 | |
| none mentioned | 28 | 6 | 250 | 58 |

Section 3 (Contd.)

Variables 052, 053, 054

IF YOU HAVE CONSIDERED AND REJECTED OTHER PROJECTS PLEASE NAME -

| | N |
|---|---|
| Nuffield Projects | |
| O-level Biology | 5 |
| O-level Chemistry | 7 |
| O-level Physics | 7 |
| A-level Biological Science | 7 |
| A-level Chemistry | - |
| A-level Physics | 1 |
| A-level Physical Science | 5 |
| Combined Science | 5 |
| Secondary Science | - |
| Projects supported by Schools Council | |
| Integrated Science Project (SCISP) | - |
| Science 5-13 | - |
| Project Technology | 5 |
| Loughborough Engineering Science | |
| Keele Integrated Studies | |
| Environmental Studies | |
| Project Environment | |
| Others | |
| Scottish Integrated Science | |
| Your School or LEA project | |

## Section 4 Sources of information

HOW FREQUENTLY DO YOU READ THE FOLLOWING?

5 - regularly
4 - often
3 - occasionally
2 - seldom
1 - never

| Identification No. | | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 01 | publications of the Association for Science Education | 107 | 148 | 39 | 108 | 78 | 54 | 6 | 3.3 |
| 02 | other specialist subject journals | 108 | 62 | 69 | 167 | 90 | 38 | 7 | 3.1 |
| 03 | science journals and magazines | 109 | 85 | 112 | 176 | 44 | 13 | 3 | 3.5 |
| 04 | 'Times Educational Supplement' | 110 | 130 | 68 | 123 | 79 | 30 | 3 | 3.4 |
| 05 | other educational journals | 111 | 22 | 36 | 153 | 155 | 62 | 5 | 2.5 |
| 06 | DES memoranda and circulars | 112 | 29 | 81 | 124 | 107 | 85 | 7 | 2.7 |
| 07 | LEA circulars | 113 | 105 | 104 | 113 | 65 | 42 | 4 | 3.4 |
| 08 | Schools Council 'Project Profiles and Index' | 114 | 5 | 16 | 48 | 100 | 258 | 6 | 1.6 |
| 09 | Schools Council 'Dialogue' | 115 | 32 | 32 | 58 | 92 | 214 | 5 | 2.0 |
| 10 | other Schools Council Publications | 116 | 3 | 24 | 108 | 145 | 148 | 5 | 2.0 |
| 11 | circulars from curriculum development projects | 117 | 21 | 65 | 124 | 133 | 84 | 6 | 2.5 |
| 12 | information from publishers | 118 | 83 | 158 | 103 | 58 | 29 | 2 | 3.5 |
| 13 | catalogues from scientific supply companies | 119 | 137 | 128 | 96 | 48 | 22 | 2 | 3.7 |
| | HOW OFTEN DO YOU CONSULT WITH THE FOLLOWING PEOPLE FOR INFORMATION? | | | | | | | | |
| 14 | science teachers from your own school | 120 | 253 | 118 | 51 | 5 | 4 | 2 | 4.4 |
| 15 | your head teacher | 121 | 50 | 50 | 107 | 116 | 108 | 2 | 2.6 |
| 16 | science teachers from other schools | 122 | 26 | 82 | 188 | 92 | 43 | 2 | 2.9 |
| 17 | teachers' centre staff | 123 | 8 | 22 | 63 | 120 | 217 | 3 | 1.8 |
| 18 | LEA science advisers/inspectors | 124 | 8 | 25 | 96 | 120 | 177 | 7 | 2.0 |
| 19 | teachers from curriculum development project trials | 125 | 4 | 10 | 69 | 105 | 241 | 4 | 1.7 |
| 20 | staff from curriculum development projects | 126 | 1 | 7 | 43 | 97 | 280 | 5 | 1.5 |
| 21 | Schools Council field officers | 127 | - | - | 7 | 28 | 393 | 5 | 1.1 |
| 22 | H.M.I.s | 128 | - | 1 | 34 | 117 | 276 | 5 | 1.4 |
| 23 | university staff | 129 | 7 | 32 | 106 | 110 | 176 | 2 | 2.0 |
| 24 | staff of other higher education institutions | 130 | 3 | 18 | 71 | 137 | 200 | 4 | 1.8 |

Section 4 (contd.)

HOW OFTEN DO YOU USE THE FOLLOWING SOURCES?

5 - regularly
4 - often
3 - occasionally
2 - seldom
1 - never

| Identification No. | | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| 25 | T.V. educational programmes | 131 | 29 | 31 | 71 | 116 | 183 | 3 | 2.1 |
| 26 | radio educational programmes | 132 | 2 | 11 | 37 | 88 | 290 | 5 | 1.5 |

HOW OFTEN ARE YOU ABLE TO ATTEND MEETINGS OR COURSES ORGANISED BY THE FOLLOWING GROUPS?

4 - attend all or most
3 - attend many
2 - attend a few
1 - do not attend

| | | | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| 27 | teachers' professional association | 133 | 22 | 27 | 154 | 226 | 4 | 1.6 |
| 28 | specialist subject association (e.g. ASE) | 134 | 13 | 47 | 181 | 187 | 5 | 1.7 |
| 29 | your LEA | 135 | 19 | 50 | 211 | 145 | 8 | 1.9 |
| 30 | professional centre, e.g. Royal Institute of Chemistry Centre, Biology Centre | 136 | 19 | 35 | 104 | 271 | 4 | 1.5 |
| 31 | university | 137 | 9 | 40 | 235 | 146 | 3 | 1.8 |
| 32 | other higher or further education institutions | 138 | 6 | 12 | 194 | 215 | 6 | 1.6 |
| 33 | Department of Education and Science | 139 | 1 | 12 | 137 | 278 | 5 | 1.4 |
| 34 | examinations board | 140 | 29 | 33 | 100 | 266 | 5 | 1.6 |

## Section 5. Ranking of information sources

(Variables 141 to 145)

WOULD YOU PLEASE RANK UP TO FIVE OF THE 34 SOURCES LISTED IN SECTION 4 IN TERMS OF RELATIVE USEFULNESS FOR INFORMATION ABOUT CURRICULUM DEVELOPMENT PROJECTS.
PLEASE ENTER THE 'IDENTIFICATION NUMBERS' (from 01 to 34) BELOW WITH THE MOST USEFUL IN THE TOP BOX

| Identification No. | Box | 1 | 2 | 3 | 4 | 5 | Weighted score |
|---|---|---|---|---|---|---|---|
| 01 | publications of the Association for Science Education | 111 | 40 | 30 | 19 | 11 | 854 |
| 02 | other specialist subject journals | 7 | 19 | 7 | 15 | 9 | 171 |
| 03 | science journals and magazines | 13 | 27 | 20 | 21 | 20 | 295 |
| 04 | 'Times Educational Supplement' | 28 | 22 | 29 | 23 | 23 | 384 |
| 05 | other educational journals | 9 | 9 | 7 | 11 | 6 | 130 |
| 06 | DES memoranda and circulars | 1 | 6 | 6 | 7 | 5 | 66 |
| 07 | LEA circulars | 4 | 15 | 15 | 5 | 9 | 144 |
| 08 | Schools Council 'Project Profiles and Index' | 7 | 4 | 6 | 2 | 5 | 78 |
| 09 | Schools Council 'Dialogue' | 4 | 12 | 8 | 7 | 4 | 110 |
| 10 | other Schools Council Publications | | 4 | 7 | 3 | 5 | 48 |
| 11 | circulars from curriculum development projects | 16 | 18 | 19 | 27 | 17 | 280 |
| 12 | information from publishers | 11 | 17 | 25 | 24 | 21 | 267 |
| 13 | catalogues from scientific supply companies | 4 | 6 | 10 | 14 | 21 | 123 |
| HOW OFTEN DO YOU CONSULT WITH THE FOLLOWING PEOPLE FOR INFORMATION? | | | | | | | |
| 14 | science teachers from your own school | 60 | 28 | 24 | 19 | 16 | 538 |
| 15 | your head teacher | 1 | 4 | 2 | 6 | 4 | 43 |
| 16 | science teachers from other schools | 18 | 33 | 29 | 30 | 13 | 382 |
| 17 | teachers' centre staff | 8 | 9 | 12 | 7 | 7 | 133 |
| 18 | LEA science advisers/inspectors | 9 | 15 | 18 | 13 | 14 | 199 |
| 19 | teachers from curriculum development project trials | 4 | 13 | 6 | 5 | 9 | 109 |
| 20 | staff from curriculum development projects | 7 | 6 | 6 | 2 | 5 | 86 |
| 21 | Schools Council field officers | - | 4 | - | 1 | - | 18 |
| 22 | H.M.I.s | - | 1 | - | 3 | 2 | 12 |
| 23 | university staff | 5 | 6 | 9 | 7 | 10 | 100 |
| 24 | staff of other higher education institutions | 6 | 1 | 4 | 4 | 5 | 59 |

## Section 5. (contd.)

| Identification No. | Box | 1 | 2 | 3 | 4 | 5 | Weighted score |
|---|---|---|---|---|---|---|---|
| 25 | T.V. educational programmes | 3 | 1 | 8 | 8 | 6 | 65 |
| 26 | radio educational programmes | - | 1 | - | 6 | - | 16 |

HOW OFTEN ARE YOU ABLE TO ATTEND MEETINGS OR COURSES ORGANISED BY THE FOLLOWING GROUPS?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | teachers' professional association | 1 | 2 | 3 | 3 | 5 | 33 |
| 28 | specialist subject association (e.g. A.S.E.) | 10 | 17 | 14 | 8 | 10 | 186 |
| 29 | your LEA | 17 | 8 | 4 | 7 | 11 | 154 |
| 30 | professional centre, e.g. Royal Institute of Chemistry Centre, Biology Centre | 11 | 12 | 15 | 7 | 6 | 168 |
| 31 | university | 3 | 15 | 11 | 6 | 7 | 127 |
| 32 | other higher or further education institutions | 4 | 7 | 4 | 4 | 1 | 69 |
| 33 | Department of Education and Science | 8 | 6 | 8 | 3 | 4 | 98 |
| 34 | examinations board | 3 | 3 | 9 | 4 | 4 | 66 |
| 35 | | 1 | | | 1 | | 7 |

T = 5618

## Section 6. The role of the science adviser or inspector

PLEASE INDICATE HOW IMPORTANT YOU FIND OR WOULD ANTICIPATE FINDING THE FOLLOWING ROLES OF AN LEA SCIENCE ADVISER -

4 - very important
3 - of some importance
2 - of little importance
1 - of no importance

| | | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|
| To participate in the appointment of science teachers | 146 | 72 | 160 | 120 | 76 | 5 | 2.5 |
| To supervise and assess probationary science teachers | 147 | 94 | 187 | 105 | 43 | 4 | 2.8 |
| To ensure that safety regulations are fully observed in school science laboratories | 148 | 172 | 163 | 68 | 27 | 3 | 3.1 |
| To ensure that head teachers are fully informed about curriculum developments in school science | 149 | 242 | 132 | 43 | 13 | 3 | 3.4 |
| To ensure that science teachers are fully informed about curriculum developments in school science | 150 | 336 | 70 | 16 | 7 | 4 | 3.7 |
| To recognize, support and disseminate successful local developments in science teaching | 151 | 293 | 115 | 14 | 8 | 3 | 3.6 |
| To organize in-service courses in science teaching | 152 | 319 | 89 | 15 | 7 | 3 | 3.7 |
| To inform teachers of the provision of resources by the LEA and other agencies | 153 | 317 | 90 | 15 | 8 | 3 | 3.7 |
| To advise the Authority on policy and financial or other resources for school science | 154 | 289 | 112 | 21 | 8 | 3 | 3.6 |
| To consult with teachers on the provision of resources | 155 | 298 | 112 | 12 | 8 | 3 | 3.6 |
| To advise the Authority on laboratory design | 156 | 203 | 167 | 37 | 23 | 3 | 3.3 |
| To encourage teachers to use resources | 157 | 176 | 187 | 48 | 18 | 4 | 3.2 |

## Section 7. Outcomes of science teaching

SOME OF THE POSSIBLE OUTCOMES OF A PUPIL'S EXPERIENCE IN SCIENCE ARE LISTED BELOW. WE WOULD LIKE TO KNOW THE EXTENT TO WHICH YOUR OPINION OF THEIR IMPORTANCE COMPARES WITH THE IMPORTANCE GIVEN TO THEM BY THE CURRICULUM DEVELOPMENT PROJECT(S) WITH WHICH YOU ARE MOST FAMILIAR.

Under Column (a) indicate your personal opinion of the importance of the outcomes.

5 - very important
4 - of considerable importance
3 - average importance
2 - of some importance
1 - of no importance

| | | (a) personal | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
| A knowledge of the basic facts of science | 158 | 188 | 144 | 76 | 10 | - | 15 | 4.2 |
| The development of experimental skills | 160 | 137 | 162 | 96 | 21 | 2 | 15 | 4.0 |
| The development of critical attitudes towards the effects of technology on the quality of life | 162 | 144 | 153 | 85 | 29 | 6 | 16 | 4.0 |
| An ability to handle the investigation of open-ended problems | 164 | 112 | 187 | 95 | 22 | 1 | 16 | 3.9 |
| Educational benefits of individual sciences | 166 | 38 | 91 | 159 | 92 | 23 | 30 | 3.1 |
| An understanding of theoretical concepts | 168 | 60 | 165 | 124 | 64 | 5 | 15 | 3.5 |
| The development of pupils' ability to work together | 170 | 80 | 128 | 129 | 69 | 10 | 17 | 3.5 |
| Preparation for future studies | 172 | 80 | 158 | 131 | 38 | 9 | 17 | 3.6 |
| The supply of well-qualified scientists and technologists for the nation's needs | 174 | 48 | 101 | 129 | 97 | 41 | 17 | 3.0 |
| Confidence in proposing creative solutions to problems | 176 | 79 | 183 | 109 | 40 | 5 | 17 | 3.7 |
| A critical attitude towards authority | 178 | 32 | 56 | 142 | 108 | 74 | 21 | 2.7 |
| An appreciation of the contributions individuals may make in a group situation | 180 | 37 | 110 | 135 | 107 | 25 | 19 | 3.1 |
| An understanding of and ability to use the scientific method | 182 | 132 | 163 | 99 | 21 | | 18 | 4.0 |
| The ability to use science in everyday life | 184 | 109 | 154 | 110 | 42 | 2 | 16 | 3.8 |
| The ability to take personal responsibility for planning and conducting one's own learning experience | 186 | 101 | 134 | 115 | 55 | 12 | 16 | 3.6 |
| An understanding of the social implications of scientific discovery | 188 | 86 | 135 | 127 | 57 | 10 | 18 | 3.6 |
| The ability to delay conclusions until convincing evidence is available | 190 | 96 | 154 | 111 | 46 | 9 | 17 | 3.7 |
| Favourable attitudes toward science | 192 | 86 | 123 | 128 | 48 | 30 | 18 | 3.4 |
| To facilitate competition with other countries in science and technology | 194 | 17 | 21 | 71 | 102 | 208 | 14 | 1.9 |
| Other | 196 | 28 | 13 | 2 | | 2 | 388 | 4.4 |

Section 7. (contd.)

SOME OF THE POSSIBLE OUTCOMES OF A PUPIL'S EXPERIENCE IN SCIENCE ARE LISTED BELOW. WE WOULD LIKE TO KNOW THE EXTENT TO WHICH YOUR OPINION OF THEIR IMPORTANCE COMPARES WITH THE IMPORTANCE GIVEN TO THEM BY THE CURRICULUM DEVELOPMENT PROJECT(S) WITH WHICH YOU ARE MOST FAMILIAR.

Under Column (b) indicate your impression of the importance given to the outcomes by the project(s) you are most familiar with.

5 - very important
4 - of considerable importance
3 - average importance
2 - of some importance
1 - of no importance

| | | (b) project(s) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
| A knowledge of the basic facts of science | 159 | 71 | 118 | 143 | 54 | 2 | 45 | 3.5 |
| The development of experimental skills | 161 | 175 | 140 | 53 | 18 | 2 | 45 | 4.2 |
| The development of critical attitudes towards the effects of technology on the quality of life | 163 | 54 | 104 | 119 | 70 | 40 | 46 | 3.2 |
| An ability to handle the investigation of open-ended problems | 165 | 145 | 156 | 59 | 18 | 9 | 46 | 4.0 |
| Educational benefits of individual sciences | 167 | 24 | 64 | 152 | 82 | 50 | 61 | 2.8 |
| An understanding of theoretical concepts | 169 | 65 | 118 | 127 | 58 | 18 | 47 | 3.4 |
| The development of pupils' ability to work together | 171 | 49 | 108 | 131 | 67 | 29 | 49 | 3.2 |
| Preparation for future studies | 173 | 54 | 132 | 135 | 58 | 8 | 46 | 3.4 |
| The supply of well-qualified scientists and technologists for the nation's needs | 175 | 40 | 60 | 128 | 101 | 58 | 46 | 2.8 |
| Confidence in proposing creative solutions to problems | 177 | 77 | 156 | 104 | 40 | 7 | 49 | 3.7 |
| A critical attitude towards authority | 179 | 14 | 48 | 113 | 97 | 108 | 53 | 2.4 |
| An appreciation of the contributions individuals may make in a group situation | 181 | 36 | 94 | 137 | 79 | 38 | 49 | 3.0 |
| An understanding of an ability to use the scientific method | 183 | 147 | 138 | 73 | 24 | 3 | 48 | 4.0 |
| The ability to use science in everyday life | 185 | 70 | 120 | 130 | 57 | 10 | 46 | 3.5 |
| The ability to take personal responsibility for planning and conducting one's own learning experience | 187 | 73 | 109 | 118 | 64 | 23 | 46 | 3.4 |
| An understanding of the social implications of scientific discovery | 189 | 43 | 89 | 119 | 104 | 31 | 47 | 3.0 |
| The ability to delay conclusions until convincing evidence is available | 191 | 63 | 135 | 122 | 44 | 21 | 48 | 3.4 |
| Favourable attitudes toward science | 193 | 86 | 119 | 111 | 52 | 16 | 49 | 3.5 |
| To facilitate competition with other countries in science and technology | 195 | 15 | 8 | 71 | 77 | 214 | 48 | 1.8 |
| Other | 197 | 8 | 7 | 7 | 6 | 8 | 397 | 3.0 |

## Section 8. Effects of curriculum projects

SOME OF THE POSSIBLE EFFECTS OF CURRICULUM RESEARCH AND DEVELOPMENT PROJECTS ARE LISTED BELOW. PLEASE INDICATE YOUR OPINION OF THEIR SIGNIFICANCE BY USE OF THE CODE TO THE RIGHT.

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| improve the quality of pupils' school experience | 198 | 117 | 224 | 67 | 7 | 3 | 15 | 4.1 |
| support those teachers who are already attempting to bring about change in schools | 199 | 78 | 259 | 64 | 13 | 2 | 17 | 4.0 |
| over-emphasize the role of technical aids in teaching (e.g. programmed learning) | 200 | 15 | 90 | 125 | 162 | 22 | 19 | 2.8 |
| provide resources from which teachers may select | 201 | 150 | 230 | 31 | 5 | - | 17 | 4.3 |
| increase the burden of preparation for teachers | 202 | 101 | 188 | 41 | 78 | 9 | 16 | 3.7 |
| provide packages that can be fully adopted | 203 | 19 | 120 | 118 | 128 | 29 | 19 | 2.9 |
| promise more improvements than can reasonably be expected | 204 | 32 | 149 | 141 | 88 | 3 | 20 | 3.3 |
| introduce new methods of teaching into the schools | 205 | 88 | 263 | 40 | 24 | 3 | 15 | 4.0 |
| enable an atypical group to impose unrealistic standards for the rest of the schools' population | 206 | 22 | 51 | 129 | 167 | 43 | 21 | 2.6 |
| provide schemes for teaching based on the psychology of learning | 207 | 12 | 123 | 197 | 68 | 13 | 20 | 3.1 |
| promote dissatisfaction with what has been tested over time and shown to work | 208 | 11 | 67 | 93 | 213 | 30 | 19 | 2.6 |
| demonstrate how new subject matter may be introduced at school level | 209 | 51 | 313 | 39 | 10 | 4 | 16 | 4.0 |
| promote the use of behavioural objectives | 210 | 9 | 116 | 237 | 36 | 2 | 33 | 3.2 |
| widen the aims and objectives of teaching a subject | 211 | 64 | 259 | 56 | 33 | 3 | 18 | 3.8 |
| maintain specialist divisions between subjects | 212 | 6 | 41 | 92 | 221 | 54 | 19 | 2.3 |
| provide alternatives for schools programmes | 213 | 19 | 220 | 127 | 41 | 4 | 22 | 3.5 |
| support classification of children into ability groups | 214 | 22 | 117 | 78 | 159 | 38 | 19 | 2.8 |
| influence changes in external examinations | 215 | 84 | 250 | 49 | 27 | 5 | 18 | 3.9 |
| appeal to "band-wagon" participation by teachers | 216 | 60 | 160 | 105 | 76 | 13 | 19 | 3.4 |
| influence the internal organization of schools (time-tabling, streaming, etc.) | 217 | 12 | 147 | 115 | 126 | 15 | 18 | 3.0 |
| provide a means of promoting personal status | 218 | 32 | 108 | 109 | 134 | 29 | 21 | 3.0 |

## Section 8 (contd.)

ON THE WHOLE THE EFFECTS OF CURRICULUM DEVELOPMENT PROJECTS HAVE BEEN TO -

5 - agree strongly
4 - agree
3 - undecided
2 - disagree
1 - disagree strongly

| | | 5 | 4 | 3 | 2 | 1 | 0 | Mean |
|---|---|---|---|---|---|---|---|---|
| discourage innovation because of the multiplicity of projects | 219 | 12 | 83 | 117 | 176 | 25 | 20 | 2.7 |
| encourage LEAs to provide improved facilities | 220 | 62 | 247 | 62 | 37 | 7 | 18 | 3.8 |
| provide idealists with a platform | 221 | 55 | 132 | 110 | 97 | 21 | 18 | 3.2 |
| increase outside support for change in schools | 222 | 13 | 127 | 189 | 76 | 10 | 18 | 3.1 |
| create feelings of inadequacy in teachers | 223 | 14 | 98 | 100 | 167 | 36 | 18 | 2.7 |
| support the influence of schools on local government education policy | 224 | 3 | 71 | 200 | 106 | 31 | 22 | 2.8 |
| introduce uniformity into school programmes | 225 | 3 | 72 | 73 | 212 | 54 | 19 | 2.4 |
| support the influence of schools on national government education policy | 226 | 4 | 37 | 198 | 132 | 38 | 24 | 2.6 |

## APPENDIX Q.i

### (i) LEA INTERVIEW CHECKLIST

1. What changes are occurring in your community and how are the changes affecting schools?
2. In what ways is science education changing in your schools?
3. Are the sources of these innovations from inside or outside schools?
4. Does the LEA encourage trial of materials before adoption?
5. Does the LEA invite schools to adopt particular innovations?
6. Who are the people behind adoption of the innovation(s)?
7. What assistance do they receive?
8. If a teacher wants to adopt an innovation such as......(use science and non-science example if possible) what does he do?
9. What happens with competing claims for LEA resources?
10. What have been the sources of information about outside curriculum development projects?
11. How satisfactory has information been from outside groups?
12. What is the LEA part in helping the diffusion of an innovation such as.....?
13. Does this activity occur in the early stages of availability or does the LEA wait for demand from teachers?
14. In what ways do teachers tend to come together in groups?
15. What outside sources are there which bring teachers together? Does the ATO help provide activities? Are there professional groups and higher education establishments which provide programmes for teachers?
16. What evidence is there for levels of adoption of innovation(s)?
17. Are there any innovations which have failed? Why?
18. What changes in plans occur when diffusion of an innovation encounters resistance?
19. What characteristics of organizations do you think affect innovation?
20. What characteristics of teachers do you think affect implementation of innovations?
21. What characteristics of innovations affect the rate and extent of implementation?

    (Check: cost, teacher time, physical facilities, examinations,
    pupil ability, parental expectations)
22. What questions does the LEA representative have for the interviewer? (To allow for free discussion)
23. Request permission for visiting schools and recommendations of schools to visit.
24. Give list of printed materials request.

APPENDIX Q.ii

## CURRICULUM DIFFUSION RESEARCH PROJECT

Centre for Science Education
Chelsea College, Bridges Place, S.W.6.

## QUESTIONNAIRE TO LOCAL EDUCATION AUTHORITIES

Code of Authority..............................

all replies are strictly confidential

Please complete this copy and return
it to the address above.

Section 1. Communication Factors

1. Teachers' Centres.

Does the Authority maintain Teachers' Centres? Yes ☐ No ☐

If "Yes"... How many? ☐

For each centre, please enter the following details:

| CENTRE | a | b | c | d | e | f | g | h | j | k |
|---|---|---|---|---|---|---|---|---|---|---|
| a) Staffing of centre:<br>(Please indicate the number of staff and whether Full-time=F Part-time=P)<br>i) Warden and/or "academic" staff: | | | | | | | | | | |
| ii) Technicians: | | | | | | | | | | |
| iii) Secretaries: | | | | | | | | | | |
| b) Programme of Centre<br>i) Please state percentage of time directed to secondary schools. | | | | | | | | | | |
| ii) Please state percentage of time directed to secondary school science | | | | | | | | | | |
| iii) Please indicate persons mainly responsible for planning the science programme. (Teachers = T, Warden=W, Advisers = A) | | | | | | | | | | |
| c) Please state the year in which the Centre was established. | | | | | | | | | | |

N.B. We would be interested to receive brief details of any curriculum working parties set up un connection with any of these centres.

d) Background of Wardens

**Please enter the following details:**

| Centre (reference a,b, etc., as over page.) | Type of School of main teaching experience. | Classroom "subject" of main teaching experience. | Involvement in development of National Curriculum Project (if any). |
|---|---|---|---|
| | | | |

2. Centres other than those organised by the L.E.A.

Please list any other centres, (e.g. University Departments, Schools of Education, Colleges of Education, Professional Centres etc.) which have organised courses or meetings for science teachers and are accessible to teachers in your area. Please list first those that you think are most widely used.

| Name of Centre | Location |
|---|---|
| a ................................ | .................................................................. |
| b ................................ | .................................................................. |
| c ................................ | .................................................................. |
| d ................................ | .................................................................. |
| e ................................ | .................................................................. |

How many more centres would you wish to mention in this connection? ☐

---

3. (a) Please indicate, by ticking in the appropriate columns, the frequency and place of meeting of contacts sponsored by the L.E.A.

| | Frequency | | | | Venue | | |
|---|---|---|---|---|---|---|---|
| | Never | annually | termly | more often | Education Offices | Schools | T/Centres |
| Inter-school contacts between Secondary Head Teachers | | | | | | | |
| Heads of Science Depts. of different secondary schools | | | | | | | |
| Science teachers from different secondary schools | | | | | | | |
| Science teachers from *tier-linked schools | | | | | | | |

* e.g. Middle and Upper schools, Junior and Senior High schools, etc.

(b) Is there a local science teachers' group in the Authority area? (One not affiliated to the A.S.E.) Yes ☐ No ☐

If 'Yes'
Does an L.E.A. official attend meetings? Yes ☐ No ☐

Q.06

4. L.E.A. communication with schools.

a) How does the education office communicate information related to science or curriculum materials to the schools?
(Please put in rank order 1,2,3,4,5,6,7.)

| | |
|---|---|
| Letter to headmaster | ☐ |
| Visits to inspectors/advisers | ☐ |
| Through teachers' centres | ☐ |
| Telephone to headmaster | ☐ |
| Telephone to head of science | ☐ |
| General bulletin | ☐ |
| Special curriculum bulletin | ☐ |

b) Which method does the education authority use to communicate by letter with the schools?
(Please tick the appropriate box.)

| | Yes | No |
|---|---|---|
| (i) G.P.O. only | ☐ | ☐ |
| (ii) Internal mail system only | ☐ | ☐ |
| Both (i) and (ii) | ☐ | ☐ |

---

5. Travel

a) Which method of travel is used by the adviser/inspector when he/she visits schools?
Please put in rank order 1,2,3,4.

| | |
|---|---|
| (i) Car | ☐ |
| (ii) Rail | ☐ |
| (iii) Bus | ☐ |
| (iv) Rail Bus | ☐ |

b) By which method do teachers attending centres travel?
Please put in rank order 1,2,3,4.

| | | Don't know |
|---|---|---|
| (i) Rail | ☐ | |
| (ii) Bus | ☐ | |
| (iii) Rail/Bus | ☐ | |
| (iv) Car | ☐ | ☐ |

c) How would you rate the rail service in your area?
(Please tick appropriate box.)

| Good | Fair | Poor |
|---|---|---|
| ☐ | ☐ | ☐ |

d) How would you rate the bus service in your area?
(Please tick appropriate box.)

| Good | Fair | Poor |
|---|---|---|
| ☐ | ☐ | ☐ |

e) Does the Authority arrange for the provision of special transport for:

| | Yes | No |
|---|---|---|
| (a) all secondary schools? | ☐ | ☐ |
| (b) some secondary schools in rural districts? | ☐ | ☐ |

2.07

6. Industrial Links.

a) What important science-based industries operate in or near your area?

..........................................................................

..........................................................................

..........................................................................

..........................................................................

..........................................................................

..........................................................................

b) Does any formal Industrial Link Scheme operate in your area between industry and the schools?

| | |
|---|---|
| Yes | No |
| ☐ | ☐ |

If "Yes"

Where are the "link-men" based?

..........................................................................

c) Please rate the contacts between the schools in your area and the local industry, by ticking in the appropriate box.

| | | |
|---|---|---|
| Most schools have continuing contacts. | =high | ☐ |
| About half of the schools has continuing contacts. | =moderate | ☐ |
| Very few of the schools have contacts. | =low | ☐ |
| | don't know | ☐ |

d) We would be glad to know about any courses, in the schools in your area, that are associated in any way with local Technical Colleges.

7. **L.E.A. Advisory Service**

(i) Are the Local Authority Advisers

|  |  | Yes | No |
|---|---|---|---|
|  | Home-based? | ☐ | ☐ |
|  | Office-based? | ☐ | ☐ |

(ii) How frequently do all Schools' Advisers meet together? ---------------

(iii) Please provide the following information relating to the distribution of time and responsibility for science within the Authority's Advisory Service.

| Persons | Appointment description | Year in which appointment first existed. | Expected percentage time given to science. | Position of person to whom directly responsible. |
|---|---|---|---|---|
| a |  |  |  |  |
| b |  |  |  |  |
| c |  |  |  |  |
| d |  |  |  |  |
| e |  |  |  |  |

8. Other influential persons in relation to science teaching in the area.

| Persons | Position* | Particular projects or areas of science influenced. |
|---|---|---|
| a |  |  |
| b |  |  |
| c |  |  |
| d |  |  |
| e |  |  |

* e.g. H.M.I.s, Curriculum Project Team member, Tutor in College or Department of Education, Schools Council Field Officer, etc.,

How many more persons would you like to mention in this connection? ☐

Q.09

## 9. Role of Local Authority Science Adviser/Inspector.

Please indicate how important your Education Authority finds, or would anticipate finding, the following possible roles of an L.E.A Science Adviser/Inspector by:

a) Selecting the appropriate code from the following list and entering it in the boxes in column A.

b) Ranking in column B the role-statements in order of importance 1-12(13)

4 - very important
3 - of some importance
2 - of little importance
1 - of no importance

| | A | B |
|---|---|---|
| To participate in the appointment of science teachers | ☐ | ☐ |
| To supervise and assess probationary science teachers | ☐ | ☐ |
| To ensure that safety regulations are fully observed in school science laboratories | ☐ | ☐ |
| To ensure that head teachers are fully informed about curriculum developments in school science | ☐ | ☐ |
| To ensure that science teachers are fully informed about curriculum developments in school science | ☐ | ☐ |
| To recognize, support and disseminate successful local developments in science teaching | ☐ | ☐ |
| To organize in-service courses in science teaching | ☐ | ☐ |
| To inform teachers of the provision of resources by the LEA and other agencies | ☐ | ☐ |
| To advise the Authority on policy and financial or other resources for school science | ☐ | ☐ |
| To consult with teachers on the provision of resources | ☐ | ☐ |
| To advise the Authority on laboratory design | ☐ | ☐ |
| To encourage teachers to use resources | ☐ | ☐ |
| Others ................................................ | ☐ | ☐ |

Position of person responding to item 9

.......................................

Initial development of science projects

10. Trial Schools

(a) Please indicate your Authority's response to approaches made by curriculum development bodies to use schools for trials of new materials in the following projects:

not approached = N
approached and accepted = A
approached and rejected = R
initiative came from Authority = I

| | | Reason for rejection when this occurred |
|---|---|---|
| **Nuffield Projects :** | | |
| O-level Biology .. .. .. | ☐ | .................................... |
| O-level Chemistry .. .. .. | ☐ | .................................... |
| O-level Physics .. .. | ☐ | .................................... |
| A-level Biological Science .. .. | ☐ | .................................... |
| A-level Chemistry .. .. .. | ☐ | .................................... |
| A-level Physics .. .. .. | ☐ | .................................... |
| A-level Physical Science .. .. | ☐ | .................................... |
| Combined Science .. .. .. | ☐ | .................................... |
| Secondary Science .. .. .. | ☐ | .................................... |
| **Projects supported by Schools Council** | | |
| Integrated Science Project (SCISP) .. | ☐ | .................................... |
| Science 5–13 .. .. .. | ☐ | .................................... |
| Project Technology .. .. .. | ☐ | .................................... |
| Loughborough Engineering Science .. | ☐ | .................................... |
| Keele Integrated Studies .. .. | ☐ | .................................... |
| Environmental Studies .. .. | ☐ | .................................... |
| Project Environment .. .. | ☐ | .................................... |

(b) Who made the responses given above? ....................................

| | Yes | No | Don't know |
|---|---|---|---|
| (c) Was the Education Authority asked to provide financial support for the trials? | ☐ | ☐ | ☐ |
| (d) What was the response by the Committee? | | | |
| (a) Did they provide all the help requested? | ☐ | ☐ | ☐ |
| (b) Did they provide most of the help? | ☐ | ☐ | ☐ |
| (c) Was the need to economize the most important criterion? | ☐ | ☐ | ☐ |
| (e) Were reports made to the Education Committee for schools to adopt materials after trials? | ☐ | ☐ | ☐ |

(f) If 'yes' to 10 (e), who wrote these reports?

(a) Education Officer ☐
(b) An educational administrator ☐
(c) Science inspector/adviser ☐

11. **Financing of Curriculum Development Projects.**

Please provide as much information as possible.

| | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 |
|---|---|---|---|---|---|---|---|---|---|
| (a) Total extra sum set aside in each year for science projects included in item 14. | | | | | | | | | |
| Total extra sum set aside in each year for curriculum projects other than in science. | | | | | | | | | |

(b) If the method by which schools are financed has changed within the period 1964-72, please give brief details on the back of this sheet.

12. The provision of new school labatories (1964-72)

| | Schools involved | Number of laboratories involved. | Date when laboratories came into use |
|---|---|---|---|
| In New schools<br>(Number of new schools opened .............) | (a)<br>(b)<br>etc., | | |
| New laboratories in existing schools | (a)<br>(b)<br>etc., | | |
| Renovation of existing laboratories | (a)<br>(b)<br>etc., | | |

13. Use of projects after publication of materials

(a) When schools received a grant to establish a science project was it

| | Yes | No |
|---|---|---|
| (i) a once-and-for-all payment on each project started? | ☐ | ☐ |
| (ii) an initial grant, followed by more help in subsequent years until the project was fully used? | ☐ | ☐ |
| (b) When schools had begun a project, did any stop because the Authority was unable to provide support grants? | ☐ | ☐ |
| (c) When a project has been established in a school is it likely that the school will be given further sums to sustain the project if this is found to be necessary? | ☐ | ☐ |

(d) Who would decide if support should be continued? (Please tick in the appropriate box)

(i) Education Committee ☐
(ii) Education Officer ☐
(iii) An administrative officer ☐
(iv) Science Adviser/Inspector ☐
(v) Head teacher ☐

(e) If method of financing schools has changed, please comment briefly on the back of this sheet.

---

14.

| What time elapses between the following requests and the money becoming available to the schools? | 6 months | 12 months | 18 months | 2 years | 3 years |
|---|---|---|---|---|---|
| (i) Special curriculum development grants | | | | | |
| (ii) Capital estimates | | | | | |

---

15.

| | Yes | No |
|---|---|---|
| (a) Is there any restriction placed on which suppliers of material science teachers may use? | ☐ | ☐ |
| (b) Is there appropriate financial machinery whereby a teacher may purchase "surplus" equipment or parts from which apparatus may be constructed? | ☐ | ☐ |

(c) What is the usual limit placed on the sum requested for "consumables"

(i) in biology_ _ _ _ _ _ _ _ _ _ _ _ _ _
(ii) in chemistry_ _ _ _ _ _ _ _ _ _ _ _ _
(iii) in physics _ _ _ _ _ _ _ _ _ _ _ _ _
(iv) in other science areas _ _ _ _ _ _ _ _ _ _ _ _

(d) What is the usual limit placed on expenditure from petty cash? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

16. (a) How does your Authority expect information about national curriculum development projects to spread to teachers?

Please list in rank order 1 - 6.

(i) By its own direct contacts with Head teachers ☐
(ii) Through the advisory service ☐
(iii) From professional organizations ☐
(iv) Direct from the Schools Council or other body ☐
(v) By the teachers' own efforts ☐
(vi) Through teachers' centres. ☐

---

17. (a) After curriculum development projects have been published how does the Authority enable teachers to become proficient in implementing them?

Please list in rank order 1 - 5.

(i) By setting up courses and encouraging teachers to participate in them ☐
(ii) By informing teachers of courses available elsewhere and offering support ☐
(iii) By providing courses in response to teachers requests ☐
(iv) By arranging for teachers to visit trial schools for the project ☐
(v) By supporting teachers when they request time off and/or financial support to attend courses elsewhere ☐

(b) If the Authority has provided courses for teachers relating to curriculum development projects, have these been arranged.

Please list in rank order 1,2,3,

(i) during the day ☐
(ii) during the evening ☐
(iii) residential courses ☐

---

18. Financial arrangements for teachers on courses:

| Does the Education Authority | Yes | No |
|---|---|---|
| (a) pay full expenses,(travel,subsistence,cost of course) for out-of-county/borough courses? | ☐ | ☐ |
| (b) pay part expenses for out-of-county/borough courses? If the latter, what part is paid? .................... | ☐ | ☐ |
| (c) pay full travel for in county/borough courses? | ☐ | ☐ |
| (d) pay part travel for in county/borough courses? If the latter, what percentage is paid?............... | ☐ | ☐ |
| (e) pay full subsistence allowances for in county/borough courses? | ☐ | ☐ |
| (f) pay part subsistence allowances for in county/borough courses? | ☐ | ☐ |

19.(a) How many courses in connection with the following projects has the Local Authority organized?

| PROJECT | No. of courses | | | | |
|---|---|---|---|---|---|
| | 1968/69 | 1969/70 | 1970/71 | 1971/72 | 1972/73 |
| **Nuffield Projects** | | | | | |
| O-level Biology | | | | | |
| O-level Chemistry | | | | | |
| O-level Physics | | | | | |
| A-level Biological Science | | | | | |
| A-level Chemistry | | | | | |
| A-level Physics | | | | | |
| A-level Physical Science | | | | | |
| Combined Science | | | | | |
| Secondary Science | | | | | |
| **Projects supported by Schools Council** | | | | | |
| Integrated Science Project (SCISP) | | | | | |
| Science 5–13 | | | | | |
| Project Technology | | | | | |
| Loughborough Engineering Science | | | | | |
| Keele Integrated Studies | | | | | |
| Environmental Studies | | | | | |
| Project Environment | | | | | |

(b) Who, in general, does the Authority ask to staff courses?

(c) Please mark (o) courses which have used local teachers who have attended national courses run by the project concerned.

(d) Please mark (*) courses to which local teachers already using the project have been asked to contribute.

| | Yes | No |
|---|---|---|
| 20. (a) Does the Education Committee require regular reports to be made of the use of curriculum projects in schools? | ☐ | ☐ |
| (b) Have members of the Education Committee made visits to schools to see the use of curriculum projects? | ☐ | ☐ |

If "yes", did they visit

(i) by appointment? ☐

(ii) by chance? ☐

Please tick in appropriate box.

(c) If they visited by appointment, did they come

(i) alone ☐

(ii) with both the Education Officer and the Adviser/Inspector ☐

(iii) with the Adviser/Inspector ☐

Please list in order of frequency 1, 2, 3.

---

21. Does the L.E.A. discuss matters relating to the curriculum with surrounding L.E.A's? Please tick appropriate box.

(a) Not at all ☐

(b) Informally through chance meetings of inspectors/advisers ☐

(c) Formally, by having formal and continuous links with other L.E.A.s ☐

(d) L.E.A.s to which linked as in (c)

| |
|---|
| |
| |
| |
| |

(e) How is the L.E.A. affected by Local Authority Boundary changes?

(f) Have any plans in areas affecting the curriculum been shelved because of imminent boundary changes?

## SECTION 3

### 22. Population and Organization Factors.

| | Yes | No |
|---|---|---|
| (a) Has the size of school population remained fairly constant in the last 10 years? | ☐ | ☐ |
| If "No"<br>Has the change brought (i) an increase? | ☐ | ☐ |
| (ii) a decrease? | ☐ | ☐ |

(b) Please list, in rank order, the principal towns used for work, together with an estimation of the average commuting distance.

| Town | Average commuting distance |
|---|---|
| ........................ | ........................................ |
| ........................ | ........................................ |
| ........................ | ........................................ |
| ........................ | ........................................ |
| ........................ | ........................................ |

---

### 23. Special programmes.

| | Yes | No |
|---|---|---|
| (a) Has any part of the L.E.A. area been designated in an Educational Priority Area? | ☐ | ☐ |
| If "Yes",<br>has this resulted in the provision of special courses for teachers by the L.E.A.?<br>(Please give brief details on the back of this sheet) | ☐ | ☐ |
| (b) Has the L.E.A. organized special courses for teachers in connection with the raising of the school leaving age?<br>(Please give brief details on the back of this sheet) | ☐ | ☐ |
| (c) In the last 10 years have many non nationals (or immigrant nationals) come to live in the Education Authority area? | ☐ | ☐ |
| If "Yes", has this resulted in<br>(i) the appointment of special teachers? | ☐ | ☐ |
| (ii) the creation of a special centre? | ☐ | ☐ |
| (iii) the provision of special courses:<br>for teachers? | ☐ | ☐ |
| for pupils? | ☐ | ☐ |

(Please give brief details on the back of this sheet)

(a) What proportion of secondary school teachers in your Authority are local-born people?

| High | Approx. half | Low | Don't know |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

(b) What percentage of staff change each year in the secondary schools in your Authority?

under 10% ☐
10 - 19% ☐
20 - 29% ☐
30% or more ☐

(c) How does the turnover rate of science teachers compare with other subject areas (English, Maths, Humanities, Languages, etc.,)?

| Higher | Approx. the same | Lower |
|---|---|---|
| ☐ | ☐ | ☐ |

---

## 25. Comprehensive Reorganization.

Please give brief details of plans considered and/or implemented comprehensive reorganization of Secondary Schools, in your area, since 1965.

Q.18 L.E.A. SCIENCE ADVISERS

## TIME SPENT: SUMMARY SHEET (Week ending ..............................)

| Planning and advising on:[1.] | Alone | In consultation with: | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Teachers | | | |
| | | Admins.[2] | Other Advisers | Head Teachers | Dept. Heads | First Appts. | Others | Others |
| In-service courses | | | | | | | | |
| Lab. design and organization | | | | | | | | |
| Equipment | | | | | | | | |
| Safety | | | | | | | | |
| Curriculum | | | | | | | | |
| Finance | | | | | | | | |
| Other | | | | | | | | |

| | | |
|---|---|---|
| | Public transport | Car |
| Travel | | |
| | For others | For self |
| Course participation[3] | | |
| | Science topics | Others |
| Lectures, Meetings[4] | | |
| | Science | Science Education |
| Reading | | |
| Correspondence[5] | | |

Please return to:

Mrs. J. Harding
Centre for Science Education
Chelsea College
Bridges Place
London SW6.

## APPENDIX R.1

## Numbers of LEAs and schools entering candidates for the special Nuffield examinations 1966-1973 (England, Wales and Northern Ireland)

| | 1966 | | | | | 1967 | | | | | 1968 | | | | | 1969 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LEAs[1] | Schools | | Candid-ates | Can. per sch. | LEAs[1] | Schools | | Candid-ates | Can. per sch. | LEAs[1] | Schools | | Candid-ates | Can. per sch. | LEAs[1] | Schools | | Candid-ates |
| | | LEA | Ind. or D.G. | | | | LEA | Ind. or D.G. | | | | LEA | Ind. or D.G. | | | | LEA | Ind. or D.G. | |
| Biology | 6 | 16 | 6 | 615 | 28 | 8 | 12 | 6 | 520 | 29 | 8 | 14 | 5 | 631 | 33 | 25 | 49 | 13 | 2093 |
| Chemistry | 13 | 13 | 7 | 684 | 34 | 16 | 21 | 8 | 1059 | 36 | 27 | 39 | 12 | 1796 | 35 | 43 | 78 | 23 | 3761 |
| Physics | 2 | 2 | 5 | 185 | 37 | 11 | 17 | 5 | 728 | 33 | 13 | 21 | 9 | 1035 | 34 | 32 | 57 | 15 | 254[illegible] |
| TOTALS[2] | 17 | 29 | 17 | | | 29 | 51 | 16 | | | 40 | 69 | 22 | | | 64 | 158 | 42 | |

1. LEAs with maintained schools, not with Direct Grant or Independent only.

2. Some LEAs and schools adopt more than one of the courses

# NUFFIELD O-LEVEL

|  | 1970 |  |  |  |  | 1971 |  |  |  |  | 1972 |  |  |  |  | 1973 |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | LEAs[1] | Schools |  | Candid-ates | Can. per sch. | LEAs[1] | Schools |  | Candid-ates | Can. per sch. | LEAs[1] | Schools |  | Candid-ates | Can. per sch. | LEAs[1] | Schools |  | Candid-ates | Can. per sch. |
| Can. per sch. |  | LEA | Ind. or D.G. |  |  |  | LEA | Ind. or D.G. |  |  |  | LEA | Ind. or D.G. |  |  |  | LEA | Ind. or D.G. |  |  |
| 34 | 44 | 99 | 24 | 4123 | 34 | 66 | 170 | 29 | 7138 | 36 | 79 | 224 | 28 | 10700 | 42 | 81 | 272 | 29 | 12249 | 41 |
| 37 | 67 | 152 | 36 | 6812 | 34 | 85 | 215 | 48 | 10975 | 42 | 98 | 308 | 46 | 14586 | 41 | 111 | 384 | 55 | 15816 | 36 |
| 35 | 50 | 100 | 27 | 4945 | 39 | 70 | 182 | 36 | 8909 | 41 | 94 | 297 | 39 | 14226 | 41 | 94 | 359 | 43 | 17289 | 43 |
|  | 88 | 274 | 69 |  |  | 104 | 414 | 83 |  |  | 124 | 554 | 82 |  |  | 126 | 644 | 93 |  |  |

O-level Chemistry entries for 1974 17,142

## APPENDIX R.ii

## (ii) D.E.S. COURSES IN SCIENCE 1965 - 1972

### Analysis of D.E.S. short course provision by year

| Type of course | | Numbers | | | | |
|---|---|---|---|---|---|---|
| | | Courses | Applying | Attending | Men | Women |
| **1965** | | | | | | |
| Sixth Form | Biology | 1 | 95 | 36 | 17 | 19 |
| | Chemistry and Physics | 1 | 109 | 44 | 34 | 10 |
| A New Approach to Secondary School (Reference to Nuffield materials) | Biology | 1 | 122 | 36 | | |
| | Chemistry | 1 | 89 | 43 | | |
| | Physics | 1 | 168 | 39 | | |
| Field work | | 3 | 105 | 80 | | |
| "Science" | | 1 | 59 | 48 | | |
| | Totals | 9 | 746 | 326 | | |
| 44% of those applying attended a course. | | | | | | |
| **1966** | | | | | | |
| Sixth Form | Biology | 1 | 77 | 30 | 15 | 15 |
| | Chemistry and Physics | 1 | 62 | 43 | 37 | 6 |
| New Approaches: "high level" | U.D.E.s and C.o. E.s Biology | 1 | 112 | 35 | 18 | 17 |
| | Chemistry | 1 | ? | 36 | 33 | 3 |
| | Physics | 1 | 104 | 43 | 37 | 6 |
| | teachers Biology | 1 | 57 | 33 | 16 | 17 |
| | Chemistry | 1 | 58 | 36 | 28 | 8 |
| | Physics | 1 | 53 | 35 | 30 | 5 |
| Field work | | 2 | 65 | 52 | 34 | 18 |
| | Totals | 10 | 588 | 307 | 248 | 95 |
| 52% of those applying attended a course. | | | | | | |
| **1967** | | | | | | |
| Sixth Form | Biology | 1 | 91 | 37 | 18 | 19 |
| | Chemistry and Physics | 1 | 60 | 38 | 27 | 11 |
| | Chemistry | 1 | 33 | 33 | 26 | 7 |
| | Liberal Studies | 1 | 50 | 43 | 35 | 8 |
| New Approaches to Secondary School | Biology | 1 | 68 | 40 | 36 | 4 |
| | Chemistry | 1 | 65 | 38 | 27 | 11 |
| | Physics | 1 | 48 | 36 | 32 | 4 |
| (Nuffield Secondary Science) | Science | 1 | 113 | 69 | | |
| Field work | | 1 | 43 | 27 | 11 | 16 |
| | Totals | 9 | 571 | 361 | 212 | 80 |

63% of those applying attended a course.

| Type of course | | | Numbers | | | |
|---|---|---|---|---|---|---|
| | | Courses | Applying | Attending | Men | Women |
| **1968** | | | | | | |
| Sixth Form | Biology | 1 | 75 | 36 | 32 | 4 |
| | Chemistry | 1 | 42 | 36 | | |
| | Physics | 1 | | | | |
| | General Studies | 2 | 79 | 77 | 64 | 13 |
| Biology | for Secondary Schools (referring to Nuffield materials) | 1 | 53 | 34 | 17 | 17 |
| Chemistry | | 1 | 35 | 34 | | |
| Physics | | 1 | 45 | 36 | 32 | 4 |
| New Approach to Secondary School Science (referring to Nuffield Secondary Science, Combined Science) | | 4 | 216 | 196 | 156 | 38 |
| | Totals | 12 | 545 | 449 | 301 | 66 |
| 82% of those applying attended a course. | | | | | | |
| **1969** | | | | | | |
| Sixth Form | Biology | 1 | 37 | 29 | 18 | 11 |
| | Chemistry | 2 | 75 | 65 | 50 | 15 |
| | Physics | 1 | 25 | 24 | 22 | 2 |
| | 'Combined' courses | 4 | 209 | 157 | 118 | 39 |
| | General Studies | 1 | 40 | 33 | 26 | 7 |
| Biology | for Secondary Schools (specifically Nuffield courses) | 1 | 50 | 25 | 13 | 12 |
| Chemistry | | 1 | 35 | 20 | 18 | 2 |
| Physics | | 1 | 44 | 25 | 20 | 5 |
| Biology | for "typical" O-level courses discussing relevance of new materials | 1 | 62 | 49 | 25 | 24 |
| Chemistry | | 1 | 24 | 20 | 15 | 5 |
| Physics | | 1 | 25 | 24 | 22 | 2 |
| New Approaches (Nuffield Combined Science, Secondary Science) | | 3 | 149 | 134 | 108 | 26 |
| Field work | | 1 | 26 | 26 | 14 | 12 |
| Middle School Science | | 1 | 57 | 48 | 36 | 12 |
| | Totals | 20 | 858 | 679 | 505 | 174 |
| 79% of those applying attended a course. | | | | | | |
| **1970** | | | | | | |
| Sixth Form | Biology | 3 | 154 | 89 | 48 | 41 |
| | Chemistry | 2 | 108 | 102 | 71 | 31 |
| | Physics | 2 | 63 | 60 | 56 | 4 |
| Nuffield A-level | (Biology | 4 | 136 | 133 | 86 | 47 |
| | (Chemistry | 3 | 152 | 122 | 99 | 23 |
| | (Physical Science | 3 | 106 | 93 | 60[1] | 5[1] |

(continued over)

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1. Data for one course missing.

| Type of course | Numbers | | | | |
|---|---|---|---|---|---|
| | Course | Applying | Attending | Men | Women |
| **1970 (CONTD.)** | | | | | |
| Biology } for Secondary Schools (specifically O-level Nuffield courses) | 2 | 94 | 70 | 27[1] | 7[1] |
| Chemistry } | 2 | 100 | 72 | 55 | 17 |
| Physics } | 2 | 78 | 68 | 57 | 11 |
| New Approach to Secondary School Science (organization of departments) | 1 | 70 | 52 | 41 | 11 |
| Science in Modern Society | 1 | 43 | 38 | 29 | 9 |
| Basic electronics | 1 | 63 | 21 | | |
| Science in the Middle School | 1 | 55 | 47 | | |
| Field Studies | 1 | 42 | 23 | 12 | 11 |
| Totals | 28 | 1264 | 990 | 652 | 217 |
| 78% of those applying attended a course | | | | | |
| **1971** | | | | | |
| Sixth Form Biology | 1 | 33 | 30 | | |
| Chemistry | 2 | 85 | 71 | 55[1] | 16[1] |
| Physics | 3 | 93 | 77 | 50[1] | 5[1] |
| New Approaches to Secondary School Science (Nuffield) | 4 | 212 | 178 | 88[2] | 22[2] |
| Science in the Comprehensive School | 1 | 103 | 58 | | |
| School Science for the 70s (electronics) | 1 | 83 | 61 | 56 | 5 |
| Science 11-13 and Science for Middle Years | 1+1 | 35[1] | 81 | | |
| Maths for Science | 1 | 32 | 28 | 26 | 2 |
| Science Tutors in Colleges of Education | 1 | 92 | 78 | 62 | 16 |
| Totals | 16 | 768 | 662 | 337 | 66 |
| 86% of those applying attended a course | | | | | |
| **1972** | | | | | |
| Sixth Form Biology | 1 | 115 | 30 | 13 | 17 |
| Chemistry and Physics | 1 | 73 | 65 | 41 | 24 |
| Physics (Nuffield A-level) | 1 | 47 | 39 | 35 | 4 |
| Combined Science | 1 | 62 | 36 | 29 | 7 |
| Aims, organization and methods of science teaching | 1 | 70 | 61 | 52 | 9 |
| Secondary School Science | 2 | 154 | 111 | 91 | 20 |
| Electronics in Secondary Schools | 1 | 68 | 49 | 37 | 12 |
| Outdoor experiments for School Leavers | 1 | 32 | 27 | 22 | 5 |
| Physiology of mammalian reproduction | 1 | 52 | 44 | 28 | 16 |
| ATCDE | 1 | 80 | 76 | 63 | 13 |
| Totals | 10 | 753 | 538 | 411 | 127 |
| 71% of those applying attended a course | | | | | |

[1] Data from one course missing.

[2] Data from two courses missing.

R.05

## Analysis of D.E.S. short course participation by subject (1965 - 1972 inclusive)

| Course | | No. | App. | Att. | % | M | W | Ratio |
|---|---|---|---|---|---|---|---|---|
| Sixth form | Biology | 10 | 729 | 361 | 49 | 189[1] | 149[1] | 1.3:1 |
| | Chemistry | 7 | 485 | 307 | 63 | 202[1] | 67[1] | 3.0:1 |
| | Physics | 7 | 181[1] | 161[1] | 89 | 128[2] | 11[2] | 11.6:1 |
| | Chemistry and Physics | 4 | 304 | 190 | 62 | 139 | 51 | 2.7:1 |
| | Other Combined Courses | 5 | 271 | 193 | 71 | 147 | 46 | 3.2:1 |
| | Liberal (Gen.) Studies | 4 | 169 | 153 | 90 | 125 | 29 | 4.5:1 |
| Nuffield A-level | Biology | 4 | 136 | 133 | 98 | 86 | 47 | 1.8:1 |
| | Chemistry | 3 | 152 | 122 | 80 | 99 | 23 | 4.3:1 |
| | Physics | 1 | 47 | 39 | 78 | 35 | 4 | 8.7:1 |
| | Physical Science | 3 | 106 | 93 | 88 | 60[1] | 5[1] | 12.0:1 |
| O-level | | | | | | | | |
| Biology | With reference to Nuffield materials | 6 | 568 | 276 | 49 | 139[2] | 86[2] | 1.6:1 |
| Chemistry | | 6 | 238[1] | 171[1] | 72 | 102[2] | 27[2] | 3.8:1 |
| Physics | | 6 | 443 | 207 | 47 | 157[1] | 21[1] | 7.5:1 |
| Biology | specifically for Nuffield courses | 3 | 144 | 95 | 66 | 45[1] | 19[1] | 2.4:1 |
| Chemistry | | 3 | 135 | 90 | 67 | 73 | 19 | 3.8:1 |
| Physics | | 3 | 122 | 93 | 76 | 77 | 16 | 4.8:1 |
| Secondary Science, Combined Science (Nuffield) | | 12 | 844 | 688 | 81 | 443[3] | 106[3] | 4.2:1 |

---

1. Data from one course missing.
2. Data from two courses missing.
3. Data from three courses missing.

**CURRICULUM DIFFUSION RESEARCH PROJECT** **APPENDIX R.iii**

**PERCEPTION OF PROJECTS:**

O-LEVEL PROJECT
SECONDARY SCIENCE
SCISP

**FRAMEWORK FOR QUESTIONING**

I **Target Population**

Who would you like to use it with?

(Is it a realistic O-level?)

II **Aims and objectives**

Do you think there was a need for the project?

How different do the aims appear from those of traditional courses?

What sort of effect is it intended to have on the pupil?

III **Methods**

Does the term "Nuffield approach" mean anything to you?

How do the methods differ from "traditional" course?

How does the work of the teacher (pupil) differ using the project materials compared with a more traditional approach?

Do you see any particular advantages or disadvantages in using the methods of the project?

IV **Materials**

What impression have you formed of the published materials?
(Prompt - how easy are they to use by teacher?
by pupils? )

What is your impression of apparatus specially designed or developed for the project?

V **Cost**

Have you any idea of the likely cost of introducing the project?
Is this realistic?

How does the cost of running compare with traditional courses?

VI **Effects**

What, do you think, have been the effects of the project?
(Prompt - on pupils' attitude to science?
on examinations? )

Is/was it worth doing?

JH/2.73

**CURRICULUM DIFFUSION RESEARCH PROJECT** **APPENDIX R.iv**

**COMMUNICATION PATTERNS WITHIN TEACHING**

## 1. TEACHING PRACTICE

(a) Are you a co-tutor, or do you act regularly as a supervisory teacher for students on teaching practice? ☐

If 'yes'

(b) for which institutions?......................................

..............................................................

(c) how often do you meet at the institution in a year
(i) formally ....................
(ii) socially ....................

(d) is your contact confined to the tutor's visit to your school? ....................

(e) how much of the discussion you have with supervising tutors is directed to science education? ....................

(f) how much extra time does teaching practice supervision take? ....................

## 2. EXAMINING

(a) Do you examine for G.C.E.? ☐
C.S.E.? ☐

If 'yes'

(b) Details of subject area ....................................

(c) How many meetings per year? ...............................

(d) Are you a member of an advisory panel for
G.C.E.? ☐
C.S.E.? ☐

If 'yes' - how often do you meet? ....................

(e) Do you meet regularly with other teachers to discuss
G.C.E.? ☐
C.S.E.? ☐

If 'yes', how often? ....................

R.08

3. MEMBERSHIP

(a) Are you a member of the A.S.E.? ☐

If 'no'

(b) Why not? ..................................................

(c) Do you belong to any other organization of science teachers, e.g. professional teachers' centres? ☐

4. MEETINGS in connection with science teaching in the last year (omitting those mentioned in 1 and 2)

(a) Evening meetings

| Where held? | Who organized? | Topic | No. Sessions |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

(b) Week-end meetings (one day or half day)

| Where held? | Who organized? | Topic | No. Sessions |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

(c) How many one day or half-day meetings in school time have you been able to attend? ☐

5. MEETINGS in connection with other aspects of education.

(a) Evening ____ (b) Week-end ____ (c) School time ____

6. COURSES

(a) How many courses lasting 3 days or more have you attended in the last 3 years? ☐

(b) Have these been in term-time or vacation? ..................

(c) Purpose of course ..................................................

R.09

7. CONTACTS FOR ADVICE

To whom would you go for advice if you

(a) had problems in the teaching of new material in your own specialism area?

..........................................................

(b) wanted advice on apparatus or materials?

..........................................................

(c) had organizational problems?

..........................................................

(d) Who comes to you for advice?

..........................................................

8. COMMITMENTS

What regular commitments have you beyond those involving your professional teaching?

| | Details | Time commitments |
|---|---|---|
| (a) "Extra-curricular" activities in school | | |
| (b) Family<br>e.g. meals, small children, aged relations | | |
| (c) Youth work | | |
| (d) Religious | | |
| (e) Recreational | | |
| (f) Others | | |

9. SCHOOL FACTORS

(a) Size of teaching staff ....................................

(b) Size and make up of science department

Biology ____ Chemistry _____ Physics ____ Others ____

9. **SCHOOL FACTORS** (CONTD,)

(c) Staffroom discussion?

(d) How separate or integrated is science department into the staff?

(e) Morale of staff towards change

(i) ROSLA ..........................................

(ii) Comprehensive reorganization ..........................

(iii) Boundary changes (LEA) ..........................

10. **CAREER**

(a) What general career pattern do you see for yourself in the future?

..........................................................

(b) What would be your next step in change of post?

..........................................................

(c) If you were not actively involved in science teaching, what would you like to be doing?

..........................................................

11. **OUTSIDE CONTACTS**

(a) What is the occupation of husband/wife (if exist)?

..........................................

(b) What are the occupations of the 3 people you spend most time talking to out of school?

..........................................

..........................................

..........................................

12. **NAME** .............................. **Appointment**.........................

JH/5.12.72

## APPENDIX S

## Case Studies: Research Report

J. Harding

### (i) General

#### A. Role of case studies

The chief aims of the case studies programme was seen to be those of making comparisons and of exploring the processes of communication and decision-making. To these was added later the exploring of teachers' perceptions of curriculum development projects in science.

#### B. Choice of local authority areas for case studies

The concept of a communication-support system[1] was used to identify locations in which to pursue the studies. It was suggested that one way of structuring the enquiry to encompass these aims would be to identify LEA areas scoring high in communication-support and those with low scores. Teachers in the schools in these areas operate within identifiably different environments. In each area one would expect to find those who use projects extensively and those who do not, leading to a four-cell analysis, as follows:

| | | Local Authority Level | |
|---|---|---|---|
| | | High Communication-Support | Low Communication-Support |
| At Teacher Level | Adopters | P | Q |
| | Non-adopters | R | S |

It was anticipated that enquiries in schools within cells P, Q, R and S might lead to interesting comparisons of communication patterns and provide data for an investigation into decision-making.

One Authority had not been interviewed, while for another there was insufficient data to give a score. Authorities within the Greater London area were excluded because of the complexity of communications there. The county Authority scoring highest and that obtaining the lowest score were then selected. The choice of county boroughs proved a greater problem. The borough obtaining the highest score was excluded as it was very large and would demand too much of the time available for case studies to cover the same proportion of school visits as was planned in the county Authorities. The borough scoring lowest was excluded since it appeared to have too little activity within it to provide populations in the high adopter/low communication-support category. It was decided to choose the next lowest county borough in rank order and to select a borough that appeared to match it in situation and size from the middle rank of scorers.

---

[1] See Chapter 11.

When percentage adoption scores of Nuffield O-level projects in 1973 for these four authorities were examined it was found that the two low in communication-support scores were also non-adopters, while the high and moderate communication-support Authorities were among the high adopters i.e. more than 20% adoption as defined in Chapter 7. It appeared, therefore, that we had chosen four LEA areas that would provide evidence toward the testing of the hypotheses formulated and, hopefully, to provide populations for cells P, Q, R and S of the communication-support/adoption grid.

### C. Choice of schools for case studies

The following criteria were kept in mind when choice of schools was made:

at least half of the secondary schools in the Local Education Authority area should be visited;

as many as possible of the schools receiving mailed questionnaires from the project should be included;

where variety in organization, size, sex of pupil and situation existed as representative a sample as possible should be chosen;

where a tiered system of secondary schools operated the choice should be largely from the schools containing 13-16 year old pupils;

schools should be accessible from a convenient centre.

### D. Choice of projects for perception studies

It was decided initially to include those projects relevant to the 13-16 age group, (i.e. the O-level projects in the separate sciences, Secondary Science and SCISP) since pupils in this range would be found in grammar, comprehensive and secondary modern schools. These five projects represented a useful range in ability of target population, in time interval from publication date and of specialist or integrated science programmes.

However, it became apparent that to attempt a comprehensive survey of communication patterns it would be necessary to visit at least some of the junior secondary schools where a tiered system operated. This required that Combined Science be added to the projects under enquiry and it emerged as an important project in one other area where the schools were organized on an 11-16 or 11-18 pattern.

### E. Procedures for arranging a case study visit

An approach was made to the Local Education Authority, through the person who had become the Curriculum Diffusion Research Project contact in the Authority, to obtain permission to carry out a programme of visits to the schools. This was readily given, but, in three of the four areas, it was stressed that the schools were entirely free to accept or reject a visit as they saw fit. In the fourth area the Science Adviser offered to negotiate for the visits. This offer was accepted and a list of the schools chosen, with alternatives, was provided by the project.

In two other areas a letter was sent to the Head Teacher, giving information about the research project, referring to the questionnaire study, if relevant, and suggesting that the interviewer would telephone the following week. Some Heads replied at once (only one with a refusal to burden his staff with further commitments at a time of reorganization and following a prolonged involvement with another project based at the local university) and final arrangements were made with the Head, the school secretary or the head of science. This was followed by a letter confirming the date of the visit and anticipated time of arrival and repeating the interviewer's request to talk with the head of science and as many of the other science teachers as possible as and when they were available during the day. In a few cases the visit was restricted to a half day only, but mostly the interviewer was able to spend the whole day in a school and was very kindly welcomed to lunch with the Head Teacher and/or members of the science staff.

Plans were made to visit the remaining area in the spring. Difficulties arose over term dates involving an early Easter. The LEA representative advised an initial approach by telephone to certain schools for visits the following week. This was done, but proved less satisfactory, as the request to talk with as many teachers as possible was misunderstood and the interviewer found herself talking only with the head of science, or with a whole group of science teachers. Arrangements made as described above, with the other schools in the area, were more successful.

## F. A visit to a school

A case study visit to a school typically involved a brief meeting with the Head Teacher, several of whom were interested to know more about the research project. The interviewer would then be passed to the head of science, with whom the pattern of science courses in the school was discussed.

Where preceding communications were clear the head of science had most probably arranged a programme of meetings during the day with members of the science staff, sometimes arranging for colleagues to be freed to talk with the interviewer. Where some confusion existed about the purpose of the visit hasty consultations took place, discussions were pursued in front of classes, or at break in a crowded staffroom - not ideal arrangements for any of the participants. More than once some absence of a science colleague upset carefully laid plans. The most relaxed interviewing took place in Authority (B) where the bulk of visits coincided fortuitously with school examinations! In Authority (D) the problems associated with the first term of a major reorganization of schools caused an added preoccupation for the staff involved.

When talking with a teacher the interviewer would most likely begin by asking what teachers thought of the Nuffield Science Teaching Projects, using a lightly structured framework of questions.[1] Then, if time permitted, they would proceed to the more personal structured communication questionnaire.[2]

Time too frequently ran out before this could be completed, so that in the second round of visits an attempt was made to distribute copies of the questionnaire to teachers at the beginning of a visit, if an opportunity arose (e.g. during morning break in a prep. room). Some hostility was aroused in a few cases by the wording of the document (it was intended as a prompt schedule for the interviewer who entered replies on it) and in one school its completion became a joint activity accompanied by a certain amount of ribaldry!

In areas (C) and (D), therefore, the questionnaire was used only by the interviewer as the opportunity arose.

Any person or institution from outside the school, mentioned by any science teacher, was approached while the interviewer was in the area, or later by post, in an attempt to map the communication patterns involving the science teachers in an area.

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1. See Appendix R.(ii)
2. See Appendix R.(iii)

In retrospect the programme for one visit appears too ambitious to be carried out rigorously. A head of science may possibly arrange to be free, or arrange for a visit to occur when he is not timetabled with a class, but the interviewer found that it was unrealistic to expect more than about 15 or 20 minutes to be spent with other teachers. If research requires more contact time, several return visits to the school would be necessary, with the possible outcome that the school would be unwilling to entertain involvement with future research.

The general impression gained was that the interruption caused by one day's visit was not resented: the interviewer was almost invariably received with great courtesy and kindness and a surprising number of teachers expressed their appreciation of the opportunity to discuss some of the fundamental issues of science education.

### (ii) Case study Local Education Authorities

### A. Local Education Authority (A)

county authority; size category[1] - secondary school population - large

12 schools visited, all by J.H. (a - h) January 1973
(j - m) June 1973

| | | | | Teachers interviewed | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| School | Situation | Size | Organization (all mixed) | Biology | | Chemistry | | Physics | | Comb. | |
| | | | | M | F | M | F | M | F | M | F |
| a | rural | 1000+ | 11-18 comp. | 1 | | 1 | 1 | (1) | | | |
| b | rural | 1000+ | 11-18 comp. | (1) | | | | 1 | | 1 | |
| c | rural | 1000+ | 14-18 comp. | 1 | | (1) | | 1 | | 1 | |
| d | rural | 801/1000 | 14-18 comp.* | 1 | 1 | 2 | | 1 | | | |
| e | outer city | 801/1000 | 14-18 comp. | 1 | | (1) | | | | | |
| f | outer city | 1000+ | 14-18 comp. | | | | | (1) | | | |
| g | small town | 1000+ | 14-18 comp. | (2) | | 1 | | 1 | | | |
| h | small town | 1000+ | 14-18 comp. | 1 | 1 | (1) | | 1 | 1 | | |
| j | outer city | 401/600 | 11-14 comp. | 1 | | (1) | | 1 | | | |
| k | outer city | 601/800 | 11-14 comp. | | 1 | (1) | | | | | 1 |
| l | rural | 601/800 | 11-14 comp. | | 1 | 1 | | (1) | | 1 | |
| m | rural | 801/1000 | 11-14 comp. | | | | | (1) | | | |
| 12 | | | | 9 | 4 | 10 | 1 | 10 | 1 | 3 | 1 |

( ) denotes category containing head of science

* no overall head of science

39 teachers interviewed: 32 men, 7 women

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[1] See Chapter 7.

Use of projects by schools:

| Projects | Full use for some groups | About to use | "Some use" | "Interested" |
|---|---|---|---|---|
| Nuffield O-level - Biology | a, d, e, g, h, l, m | f, | c | |
| Chemistry | a, b, g, l, m | h, | c, e | |
| Physics | a, b, d, g, l, m | e, f, h | c | |
| Combined Science | j, k | | | |
| Secondary Science | b, c, l, m | | a, g | j, k, d(?), f(?) |
| SCISP | | | | c |

B. Local Education Authority (B)

county authority; size category - secondary school population - medium

10 schools visited: 7 by J.H., a - g } February 1973
3 by R.N., h - k }

Most schools in this Authority were at some stage of General Secondary to Comprehensive by growth. There was some uncertainty about the conversion of the few grammar schools to comprehensive in 1973.

| | | | | Teachers interviewed | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| School | Situation | Size | Organization | Biology | | Chemistry | | Physics | | Comb. | |
| | | | | M | F | M | F | M | F | M | F |
| a | rural/ small town | 401/ 600 | 11-18 girls<br>Gr. to Comp. 1973 | | 1 | | (1) | | 1 | | 1 |
| b | rural | 401/ 600 | 11-16 mixed<br>Gen.Sec. to Comp. 1973 | | 1 | | | (1) | | | |
| c | rural | 401/ 600 | 11-16 mixed<br>Comp. 1970 | | 1 | 1 | | (1) | | | |
| d | outer city | 601/ 800 | 11-18 mixed<br>Comp. 1970 | (1) | 1 | 1 | | 1 | | | |
| e | outer city | 801/ 1000 | 11-18 mixed<br>G.S. to Comp. 1973 | | 1 | 3 | | (3) | | | |
| f | rural/ urban | 1000+ | 11-18 mixed<br>Comp. 1968 | (2) | | 1 | | 1 | | | |
| g | outer city | 1000+ | 11-18 mixed<br>Comp. 1968* | 1 | | 2 | | 2 | | | |
| h | small town | 1000+ | 11-18 mixed<br>G.S. to Comp. 1973 | | | 1 | | (1) | | | |
| j | rural | 401/ 600 | 11-18 mixed<br>G.S. to Comp. 1973 | 2 | | (1) | | 1 | | | |
| k | rural/ urban | 1000+ | 11-18 mixed<br>Comp. 1955 | | | | | (1) | | | |
| 10 | | | | 6 | 5 | 10 | 1 | 12 | 1 | 0 | 1 |

( ) denotes category containing head of science

* no overall head of science

36 teachers were interviewed: 28 men, 8 women

Use of projects by schools

| Projects | Full use for Some groups | Some use | "interested" |
|---|---|---|---|
| Nuffield O-level Biology | none | a, b, e, f | |
| Chemistry | none | a, b, f, g | |
| Physics | none | a, b | |
| Combined Science | c, d, h | | |
| Secondary Science | d, e, | a, f, g, h, j | |
| SCISP | | | a, d (but both rejected) |

C. Local Education Authority (C)
county borough authority; size category - secondary school population - small

7 schools were visited, all by J.H., April, May 1973; all were urban and 11-18.

This Local Authority has had a mixed system of school, mostly single sex: two highly selective grammar schools, several bilaterals (grammar and secondary modern), one purpose-built mixed comprehensive and several secondary modern. The plan was thatall should become comprehensive in the near future.

| | | | Teachers interviewed | | | | | |
|---|---|---|---|---|---|---|---|---|
| School | Size | Organization | Biology | | Chemistry | | Physics | |
| | | | M | F | M | F | M | F |
| a | 1000+ | mixed, comprehensive 1970 | (1) | | | 1 | 1 | |
| b | 601/800 | girls) bilateral | | (1) | | | | |
| c | 601/800 | boys to | | | | 1 | (1) | |
| d | 601/800 | girls comprehensive | | (1) | | | | |
| e | 801/1000 | boys) 1973 | 2 | | (2) | | 1 | |
| f | 401/600 | girls, grammar | | 1 | 1 | | (1) | |
| g | 401/600 | boys, grammar | 2 | | (1) | | 2 | |
| 7 | | | 5 | 3 | 4 | 2 | 6 | 0 |

( ) denotes category containing head of science

20 teachers were interviewed: 15 men, 5 women.

### Use of projects by schools

| Projects | Full use for some groups | Some use | "interested" |
|---|---|---|---|
| Nuffield O-level Biology | none | a, d, f, g | |
| Chemistry | none | c, g | |
| Physics | none | g | |
| Combined Science | a, b, e, | f, | |
| Secondary Science | | b, e | d, |
| SCISP | | | b, e (planning to use) |

## D. Local Education Authority (D)

county borough authority: size category - secondary school population - small

5 schools were visited; all by J.H., October 1973; all urban.

This Local Education Authority had begun the reorganization of its secondary schools to middle schools and upper schools. Some secondary modern schools were becoming 13-18 schools, but most were to be 9-13 schools.

| School | Size | Organization | Teachers interviewed | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Biology | | Chemistry | | Physics | |
| | | | M | F | M | F | M | F |
| a | 401/600 | girls: gram. to upper | | 1 | | 1 | | (1) |
| b | 601/800 | mixed: sec.mod. to upper | | | | | (1) | |
| c | 201/400 | mixed: sec.mod. to middle | | 1 | | | (1) | |
| d | 801/1000 | mixed: gr.&tech to upper | | 3 | 1 | 1 | (2) | |
| e | 601/800 | boys: gram. to upper | 1 | | (2) | | 1 | |
| 5 | | | 1 | 5 | 3 | 2 | 5 | 1 |

( ) denotes category containing head of science.

17 teachers were interviewed: 9 men and 8 women.

### Use of projects by schools

| Projects | Full use for some groups | Some use | "interested" |
|---|---|---|---|
| Nuffield O-level Biology | a, | d | |
| Chemistry | a, d, e | | |
| Physics | c | a, e | |
| Combined Science | b, c | | |
| Secondary Science | e | a, b | |
| SCISP | | | e |

## (iii) Perception of Projects

Synopsis of teachers' comments.

### A. Nuffield O-level Biology

**L.E.A. (A)**

School from which response came

**Interviewer:** Who would you use the course for? Is it a realistic O-level course - could you use it for all the pupils who would want to take an O-level in biology?

**Teachers:** Only for about 12% of our pupils. a

Only for the upper ability range - more pupils will get an O-level pass with a more traditional board. c,h,d,l

Only for some - we give a choice - girls do better with J.M.B. We use it for less than half our O-level candidates - girls prefer to soak up information. d

It is excellent for some, but girls prefer something more cut and dried and less open-ended. h

The folk-lore is that it favours the more intelligent.

I use it for all doing O-level. e

We intend to use it for all the O-band. f

It's not suitable - we need a course that 60-80% of the pupils can follow. b

**Interviewer:** Was there a need for the project - was it worth doing?

**Teachers:** Yes, traditional courses had too much theory. a

Yes, it has stimulated science teaching. b

It did a fantastic job - we now need another. b

Yes, biology was compartmentalized - it broadened it out and made links with other subjects. c

Yes, traditional courses were stale, Nuffield Biology was exciting. d

Yes, to make biology teaching more appropriate - it had no flavour of biology. I was a keen biologist in spite of my school biology. e

Yes, traditional courses were out-of-date; Nuffield is more relevant to present needs. h

It was very necessary, but not for this school. g

It has brought about changes in traditional O-level syllabuses. c,d,e,g,h

Yes, I am primary trained and see the need for secondary school biology to change. l

**Interviewer:** What chief differences do you see between the Nuffield biology and a more traditional course?

**Teachers:** In the past pupils learned facts as in history or geography - the same activity whatever the subject - now they can operate as biologists. The emphasis is on process rather than content. e

Traditional courses were cram courses, learning facts, book work and regurgitation. a, c, m

In the Nuffield course pupils "do" and understand, they discover for themselves, b, g, m

operate as a scientist. g

There is more stress on principles, on reasoning and thinking. d, h

| **L.E.A. (A)** (Contd.) | **School from which response came** |
|---|---|
| Interviewer: What chief differences do you see between the Nuffield biology and a more traditional course? | |
| Teachers: It encourages curiosity and a willingness to think. | b |
| The teacher was a purveyor of facts, now is more in the background to help. | g, h, b, d |
| Same aim - to get O-level or CSE - to get as much useful science into them as possible. | l |
| Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way? | |
| Teachers: It's more enjoyable for me and this must rub off on the pupils. I like the methods. | e |
| It's more work for the teacher. There's a lot more preparation to do. | l, b, c |
| It's ten times harder work. | h |
| The effect on the teacher is wearing - noisier lab. | l |
| You need good technicians. | b |
| There's not enough time. | g, l |
| The exams are difficult - many pupils can't understand what the questions are getting at. They are conditioned by all other subjects to learn and regurgitate facts. | d |
| The Nuffield Sixth can't write. | h |
| There are big gaps in knowledge in the sixth. | d |
| It's stopped teachers inventing and thinking for themselves - we haven't designed a bit of apparatus for years. | g |
| (1 headmaster) It encourages science teachers to ask for too large a share of the cake in time and resources. | e, g |
| Other exam. syllabuses allow more flexibility - with Nuffield you're tied to the text. | g, h |
| University types get frustrated by playing with things with their hands. | l |
| Interviewer: What is your opinion of the materials? | |
| Teachers: They are well thought out but the presentation is too difficult for most pupils. | h |
| The style of writing is too difficult - we have to modify. | a |
| The language prevents use of the texts. | b |
| They're generally very good as a starting point - we can then modify. | e |
| We've modified so much I can't remember what's in the texts. | g |
| I've used it only piece-meal and have no criticism. | c |
| There are problems in "wrong" discoveries. | m |
| Not enough feed-back to establish confidence in process for the child. | m |
| Interviewer: What about expense? | |
| Teachers: Initial grant was adequate (most schools) | a,d,e,f,g,h |
| Running costs are no different from a good traditional course. | b, d |
| It's very much more expensive | h |
| It depends on the teacher. | e |
| The texts are expensive | a |

S.10

**L.E.A. (B)** **Nuffield O-level Biology** **School from which response came**

Interviewer: Who would you use the course for? Could you use it for all the pupils who would want to take an O-level in biology?

Teachers: It is designed for the top 10%. g
It is only for the brightest and the bright can see the answer without needing experiments. j
It is only suitable for 50% of the O-band in a comprehensive school. f
It was written for grammar schools, for brighter kids. I have heard more can get an O-level with a more traditional course. I use the materials for year 3 for all pupils and select from years 4 and 5. d
We can't use it to examination for our children. e
We don't use it as a course, but it can be modified. b.

Interviewer: Was there a need for the project? Was it worth doing?

Teachers: Yes, I always welcome new ideas - the old exams were constraining. b
Yes, to support the moves made by the S.M.A. - Nuffield has caused me to change. d
Yes, biology needed rethinking - it has affected exam. boards. d, e
Yes, it's put a bit of life into it - I used materials when J.M.B. changed. j
Yes, it was like a breath of fresh air - an opportunity to rethink. I was already thinking this way. f
Yes, to get more practical work into the sciences. g
It was right to set the ideal - reality is different. l

Interviewer: What chief differences do you see between the Nuffield project and a more traditional course?

Teachers: The change has been from emphasis on recall to scientific thinking. b
The aim is to educate, not to train them to give the right answer. b
Courses used to be cramming to pass an exam. b, g
The teacher gave out information, b, e
now the pupils have to plan experiments, think for themselves, find out through practical work and reason out the answers. c, d, j
The emphasis is on discovery and thinking. f
"Experiment to show...." has become "Experiment to find out .." j
The teacher is there when he is wanted. b
The change to pupil experiment work is very good. a
We were not taught in labs until the sixth form (young teacher) b

Interviewer: What advantages or disadvantages do you see in working in the "Nuffield" way?

Teachers: I can chat with the children and get to know them. b
The children do think and work things out. e
Pupils' interest is greater and the labs. are in demand out of lesson time. b
I was very taken with it. d
I approve of pupil-based work. l
You can educate working this way. b, f
Pupils work harder - they can't sit at the back and switch off. b
It is enormously slower and fervently resisted by pupils not used to it. f

**School from which response came**

**L.E.A. (B) Contd.)**

Interviewer: What advantages or disadvantages do you see in working in the "Nuffield" way?

Teachers: The demands on the teacher are fantastic.
It's harder work for the teacher, but more interesting. b
There's no time to modify. You haven't time with average kids. j
You can't visit all the kids in a class and anyway children prefer to learn by heart. g
It involves more stress and is difficult to plan for. f
You need more lab. technicians. j, g
The labs. are not equipped or designed for this approach. a

Interviewer: What is your opinion of the materials:

Teachers: I don't like the books - they're too ponderous - even intelligent children can't see what's required. a
The language is too difficult. j, b, g
It's designed for the well-educated child - got some nice long words in it! j
Other text books are better as they give facts. d
There's no index so it's difficult to use flexibly. b
I went on a course and was impressed how often experiments failed even in the hands of experienced people. f

Interviewer: What about expense?

Teachers: The running costs are high, especially for fresh materials. a
We must pool our resources. d
The status of Nuffield has made money available. f
The money is there if you push. l
We are slowly building up. e, b
Individualized learning is economical and we've had money to buy apparatus each year. b
It's worth it if you can afford it. j
We can't afford the books j

**L.E.A. (C)** **Nuffield O-level Biology**

Interviewer: Who would you use the course for? Could you use it for all the pupils who would want to take an O-level in biology?

Teachers: No, we haven't the time. f
Some parts are too difficult for some classes a
Year 1 is difficult - I can use it only for top 15-20%. e
No - I prefer an O-level that is more closely related to the CSE. a
We use Nuffield materials only with top two-thirds in Years 1-3 l

Interviewer: Was there a need for the project? Was it worth doing?

Teachers: Yes, I returned to schools as a middle-aged graduate and found biology was not much different from my own school days - I felt the need for new ideas. b
It has had a tremendous effect on the way teachers think about science teaching. b
Our Board has changed, but not towards the Nuffield way. b

**L.E.A. (C)** (Contd.)

School from which response came

Interviewer: Was there a need for the project? Was it worth doing?

Teachers: Yes, I was involved in trials work in Scotland; the girls come out all starry-eyed and you can really get them enthusiastic. c
Intelligent girls don't need the discovery approach - they can "see" the answers. They feel a lot of the experiments are a waste of time. f

Interviewer: What chief differences do you see between the Nuffield project and a more "traditional" course?

Teachers: There's much more interesting experimental work. b, c
Children have to think an awful lot more instead of absorbing information. c
It's more demanding on the teacher but materials give tremendous support. b
The traditional course is too much chalk and talk and boys find it dull. e
Nuffield O-level is far more interesting - I hope to do it when facilities improve. e

Interviewer: What advantages or disadvantages do you see in working in the "Nuffield" way?

Teachers: Young teachers can hide behind practical work if they are not critical. The pendulum has swung too much the other way - chalk and talk has got some value. a
I enjoy teaching Nuffield-type work, but girls are most reluctant to do an experiment. b, c
The less able don't like open-ended work. They like to know what they are supposed to find out and see how to get the right answer. b
The practical work needs a lot of assistance and preparation. e
We have only one lab. technician and mostly part-time staff. b
We haven't time to do Nuffield O-level as choice is made at the end of Year 4. f
We operated a six year course to A-level so Nuffield O-level did not fit in. g
The universities do not like Nuffield - we've heard students had to be coached to reach standard required. f
We tried the material in year 5 but the boys were not happy, now we are following a text book and they're happier. g

Interviewer: What is your opinion of the materials?

Teachers: I don't know them well. d
Some sections need a radical rethink. a
The experiments are very reliable. b

Interviewer: What about expense?

Teachers: We were a new school and equipped to do any Nuffield O or A level. a
We tend to use those bits that don't need special apparatus. e, b
We don't have enough petty cash. e

S.13

**L.E.A. (D)** **Nuffield O-level Biology**
(The course was used in one school to examination; one other used some materials.)

| | School from which response came |
|---|---|
| **Interviewer:** Who would you use the course for? Is it a realistic O-level? | |
| **Teachers:** It is realistic for the most able; for the borderline candidates it's more difficult to get a pass. | a |
| I have been talking to other schools and they seem to enter only their best candidates. | a |
| We use it in years 1 and 2. There's too much to get through in year 3. | d |
| I don't really know it. | b, c, e |
| **Interviewer:** Was there a need for the project? | |
| **Teachers:** I was taught that way myself in Ireland. | a |
| Yes, it has had a beneficial effect. | d, a |
| **Interviewer:** What chief differences do you see between the Nuffield project and a more "traditional" course? | |
| **Teachers:** Generalized concepts are introduced earlier - perhaps too early. | a |
| The responsibility is placed on the child to find out. | d |
| I don't think "Nuffield". I prefer more traditional teaching with experiments and notes. | e |
| **Interviewer:** What advantages or disadvantages do you see in working in the "Nuffield" way? | |
| **Teachers:** It's more interesting to teach, but there's less security for the girls. | a |
| The girls didn't like year 3. | d |
| Girls need more feed-back to develop confidence. | a, d |
| With recall you know when you are right. | d |
| Process needs more training than we've time for. | d |
| It produces pupils who can think - it makes them better scientists and citizens but they don't know as much. | d |
| We had to teach the sixth form to write answers. | d |
| **Interviewer:** What about expense? | |
| **Teachers:** Grants were available. | a |
| It doesn't cost much more. | d |

## B. Nuffield O-level Chemistry

| L.E.A. (A) | School from which response came |
|---|---|
| Interviewer: Who would you use the course for? Is it a realistic O-level course - could you use it for all the pupils who would want to take an O-level in chemistry? | |
| Teachers: 10% at the very most | a |
| It's very good for 20% and very bad for the rest. | d |
| More can get an O-level by remembering and a certain level of understanding with a "traditional" course. | c, a |
| We may follow the biologists example and use it only with the best set. | h |
| Standards seem the same. Our estimates are very accurate. | g |
| No - they need to learn facts. | d |
| Interviewer: Was there a need for the project - was it worth doing? | |
| Teachers: Yes, to wake people up. | a |
| I don't really see the need. | d |
| Up-dating may have come without - J.M.B. is deliciously up-to-date | e |
| Yes - the effect on other courses justifies it. | c |
| Yes - compared to the way I was taught. | d |
| Nuffield is a different course - it may be worth doing - some say it is. | h |
| Interviewer: What chief differences do you see between the Nuffield chemistry and a more traditional course? | |
| Teachers: Traditional course was copy notes and perform standard experiments, tested by recall. | a, c, g |
| Traditional contained a lot of out-of-date processes - the change has been to principles and applications. | e |
| We did no practical until the sixth form. | d |
| Nuffield emphasized an investigational approach to establish fundamental principles. | c |
| Nuffield is more practically based and more conceptual | d |
| Nuffield stresses patterns, arouses curiosity. It brings the truth of the subject earlier. | g |
| The money. | g |
| Interviewer: What advantages and disadvantages do you see in working the "Nuffield" way? | |
| Teachers: You have to separate children. | c |
| Kids can think deeply and intuitively in a way that surprises me. | g |
| Pupils don't know chemicals, don't have enough background. | e, d |
| Pupils find it more difficult - need notes to give confidence. | d |
| It's more work for the teacher and gives more problems in class control. | d |
| I don't know it well enough yet. | h |
| It doesn't allow me to use my professional expertise. | e |

## L.E.A. (A) (contd.)

| | School from which response came |
|---|---|
| Interviewer: What is your opinion of the materials? | |
| Teachers: "Collected Experiments" is good. | a |
| It's flexible, easy to get ideas from them. | c, g |
| Data book is too difficult, background books vary. | a |
| A pupil's text is needed, but it mustn't give answers. | c |
| The apparatus is very good. | d |
| Interviewer: What about expense? | |
| Teachers: The grant is adequate. | h, e |
| Not much different. | c, g |
| You can make much yourself. | d |

## L.E.A. (B) Nuffield O-level Chemistry

| | |
|---|---|
| Interviewer: Who would you use the course for? Is it a realistic O-level course - could you use it for all the pupils who would want to take an O-level in chemistry? | |
| Teachers: Yes, I use Stage 1 and select from the rest - we do London O-level which is very like Nuffield. | a |
| We use Stage 1 for all, then don't do much more chemistry. | b |
| You can get a long way with a very intelligent few. | c, e |
| Too abstract for our children. | c, d, e |
| I have heard that pupils in a Public School are completely bored by it. | j |
| I use some of the experiments, but not the philosophy. | g |
| Interviewer: Was there a need for the project - was it worth doing? | |
| Teachers: Yes, definitely. It has stimulated science teaching with new ideas and resources and brought teachers together. | a |
| Yes, to make people think. | c, e |
| Yes, it has determined the direction of chemistry teaching, picked experts' brains. | h |
| Teachers were working this way. | h |
| Ideas do get through. | f |
| Interviewer: What chief differences do you see between the Nuffield chemistry and a more traditional course? | |
| Teachers: The emphasis is on principles rather than on description. | c |
| It gets children to research. | a |
| Instead of the teacher standing up and telling them, the pupils have to do it and find out (think out). | j, f, e |
| There's a greater depth in theory. | d |
| Teacher is directing and organizing in the background. | a |
| The teacher is assistant to the child. | c |
| The teacher has to question the child constantly to get the most out of it. | e |
| Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way? | |
| Teachers: Some fundamentals are beyond the reach of many. | c |
| It gives a better understanding of what chemistry is about. | e |
| It whips up interest, but lacks a sound theoretical background. | e, h, j |
| You can educate through it and achieve social aims. | g |

**L.E.A. (B)** (Contd.) — **School from which response came**

Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way?

Teachers: It takes the personality out of the teacher. — h
Open-endedness is not good as pupils can't work accurately enough to get results to think about. — d
Children can't handle data. — d
I don't like to see a child following a blind alley and wasting time. — g
There's danger in a child going off on its own - the best help comes from class teaching. — h, a
You need straight blackboard work to keep the house tidy. — h

Interviewer: What is your opinion of the materials?

Teachers: A lot of the experiments are good — j, g, d
"Collected Experiment" and "Sample Scheme" are good. — a
The "Sample Scheme" is too rigid.
Background books are good. — c

Interviewer: What about expense?

Teachers: We can't afford class sets of readers. — c
We can't afford gas syringes. — d
It's more costly as you get more breakages.when children use apparatus. — e
My first impression of expense put me off. — h
The expense is prohibitive. — j

**L.E.A. (C)** **Nuffield O-level Chemistry**

Interviewer: Is it a realistic O-level course? Can you use it for all who would want to do an O-level in chemistry?

Teachers: We use it in Year 1 and 2 for grammar streams. — d
Stage I can be used with top 30% — e
Yes, but you need to start in Year 1. — f

Interviewer: Was there a need for the project: Was it worth doing?

Teachers: Yes, ideas have been incorporated in other courses. — d
Yes, if my school experience is typical (young teacher) — e, f

Interviewer: What chief differences do you see between the Nuffield chemistry and a more traditional course?

Teachers: The change is from sit and learn to a very practical approach to the subject. — a
More stress on enquiry and method. — g, f
The role of the teacher has changed: he now walks round advising - it's a pleasant change. — g

Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way?

Teachers: There isn't time to develop confidence. — f
They don't have the factual content necessary for understanding chemistry. — g
The amount of time given to practical work is ridiculous. — g

**L.E.A. (C)** (Contd.)

**School from which response came**

Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way?

Teachers: Classes of 35 are too large for investigational work. d
The slower still get as left behind as when they had to churn out a load of facts. a
They couldn't draw diagrams or make records. d
The lab. technicians complain. d

Interviewer: What is your opinion of the materials?

Teachers: I bought a set but they weren't much used until the new chemist came. b
They're useful for the technicians. f
We don't need to read the Teachers' Guides - just pick experiments out. g

Interviewer: What about expense?

Teachers: We're very short of apparatus and equipment. e
(Few got as far as thinking about this.)

**L.E.A. (D)** **Nuffield O-level Chemistry**

Interviewer: Who would you use it for? Is it a realistic O-level course - could you use it for all who wanted to do O-level in chemistry?

Teachers: Yes, the whole course has been used in the technical school since 1966. Year 1 and 2 have been used in the grammar school. d
The perception that it's only for brightest is not valid. Here numbers entering have gone up since 1966 and % pass rate has improved. Honest toil is still rewarded. There's not so much emphasis on comprehension and analysis that the weaker candidate has been cut out. e
Only half our O-level candidates are successful. a
We have no lab. for chemistry. c

Interviewer: Was there a need for the project? Was it worth doing?

Teachers: Yes - it has made other boards stop and think. a
Yes, though I didn't see the need at the time. e
It has had a liberating effect on chemistry teaching introducing new ideas and techniques. d

Interviewer: What chief differences do you see between the Nuffield chemistry and a more traditional course?

Teachers: The emphasis is on experimental investigation; finding out, using information to predict something else, testing etc. a
Much experiment, fewer notes. d
Onus is on the child to find out - exploration of ideas, rather than an accumulation of facts. d
As a trials teacher the impact was in the altered approach to content, not methods - we already worked by practical investigation. I knew advanced chemistry was organized around structure, kinetics and energetics but the exciting thing was to realize school chemistry could be too. e
The money. e

| L.E.A. (D) (Contd.) | School from which response came |
|---|---|
| **Interviewer:** What advantages or disadvantages can you see in working the "Nuffield" way? | |
| **Teachers:** Girls like the practical, but find it difficult to extend to new situations. They need more feed-back to establish confidence. | a |
| Test results have been poor, we need a better balance between tradition and Nuffield. | d |
| The children enjoy the lessons more (a lab. technician). | d. |
| Time is a problem. | d, e |
| Storage is a problem. | d |
| It's very technician-dependent. | e |
| It's more work initially, but then runs itself. | e |
| **Interviewer:** What is your opinion of the materials? | |
| **Teachers:** Useful. | a, d |
| Need a text-book for consolidation. | a |
| Only about ½dozen background books are any good. | e |
| **Interviewer:** What about expense? | |
| **Teachers:** Grants were available. | a. d |
| Running costs are more as it is pupil-based. | e |

## C. Nuffield O-level Physics

| L.E.A. (A) | |
|---|---|
| **Interviewer:** Is it a realistic O-level? Could you use it for all who would want to take an O-level in physics? | |
| **Teachers:** We adapt for individualized learning and then enter for the Nuffield exam or CSE. | a |
| In Year 4 we use it for all who choose to do physics (about 180 out of 500) and next year sort out CSEs and modify the O-level course for them. | d |
| Don't know - my predecessor judged it too hard. | c |
| The concepts are too difficult for majority - designed for the top flight grammar school. | b |
| Yes, most qualify. | g |
| Only about 50% of the O-group could use it. | h |
| I'd rather not use it. | h |
| **Interviewer:** Was there a need for the project - was it worth doing? | |
| **Teachers:** There's no question that a new look was needed. | a |
| Yes, now need more work done. | b |
| It did not originate ideas - may have legitimized them. | c, h |
| Yes, because of effect on other boards. | d |
| Yes, because of the equipment produced. | f |
| I'm not sure, but it's shaken people up to look at their own teaching. | h |

L.E.A. (A) (contd.)

| | School from which response came |
|---|---|
| Interviewer: What chief differences do you see between the Nuffield physics and a more traditional course? | |
| Teachers: Traditional has more everyday relevance for the pupil, the Nuffield course requires understanding of abstract concepts. | c, b, h |
| You now teach ideas that hold the subject together - I was terrified at first as you've taken away all my physics. | g |
| The pupils have to think for themselves. | d |
| It's direct experimenting rather than collecting facts. | b |
| The methods are not vastly different. | |
| The aims are no different - it's the old heuristic method - good for the very intelligent but not as efficient as traditional methods. | h |
| The teachers' job has become more managerial. | h |
| A teacher must know his subject better for a Nuffield course. | l |
| Far more open-ended experiments. Emphasis is not on the facts to be taught, but on the way of approaching the facts. | m |
| There are problems over "wrong" answers - if conclusion matches observations I am prepared to mark "good", but parents (fathers are often engineers) complain if the conclusion is "wrong". | m |
| I don't think children like open-ended experiments. They become worried if they don't know what they are supposed to have learnt from it - this is the biggest drawback in the Nuffield physics scheme. | m |
| When the emphasis is on process you have to provide enough feedback for the child to know that he is making progress. | m |
| Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way? | |
| Teachers: Nuffield is too tied to its own apparatus - the exam is too specific. | b, c |
| It's not related enough to the world. | b, c, g |
| There's no temptation to say "read the book" | d |
| It's harder work for the teacher and it shouldn't be. | f |
| Pupils' approach is impressively different - I wouldn't be in teaching but for Nuffield. | b |
| Discipline problems can arise more easily. | h |
| Time is too short in 5 terms | h |
| Storage is a problem. | e |
| I refuse to give apparatus to a child and say "do what you can with it". | l |
| Interviewer: What is your opinion of the materials? | |
| Teachers: Apparatus is very useful. | d, e, f, l |
| Manufacturers jumped on the band wagon | h, l |
| Some manufacturers have made money out of rubbish. | l |
| The apparatus could have been developed without a project. | f |
| They overstate the case with too much emphasis on play. | g |
| Interviewer: What about expense? | |
| Teachers: Grant was adequate but initial cost is high. | b, d, f, h |
| Replacements are expensive | d, f |
| Running costs will probably be the same. | e, h |
| A lot goes on small items. | g |

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## L.E.A. (B) Nuffield O-level Physics

| | School from which response came |
|---|---|
| Interviewer: Who would you use the course for? Is it a realistic O-level course - could you use it for all the pupils who would want to take an O-level in physics? | |
| Teachers: It was planned as an O-level course and is suitable for top 35-40% in a public school (teacher with experience of trials work in a public school) | c |
| Not in toto - techniques and ideas are too advanced for the majority of pupils. | d |
| It should be used with the brightest classes from Year 1. | h |
| It is unrealistic without a warehouse for storage and an army of technicians. | j |
| I use part of it and have been surprised that the materials and approach can be used over the whole ability range. | k |
| I think more would get an O-level using it. | e |
| Interviewer: Was there a need for the project - was it worth doing? | |
| Teachers: Yes, it has made people think and generated useful discussion | a, c, k |
| Yes, it fitted well with individual investigation and mixed ability groups. | b |
| Yes, to up-date physics and get University work into the schools. | c |
| Yes, especially for teaching methods. | d, e, k |
| The practical emphasis was needed - physics had been blackboard based. | e |
| (especially in grammar schools) | (h) |
| Yes, it showed how you can state specified aims and develop an approach to achieve them. | g |
| Not really - if communications across the Atlantic had been better. | j |
| Interviewer: What chief differences do you see between the Nuffield physics and a more traditional course? | |
| Teachers: An emphasis on rote learning of content, followed by recall has given place to a think-type activity of experiment and discussion. | d |
| Pupils think for themselves- discover rather than be told. | h, k |
| It has created time for children to experience rather than be crammed with facts. | c, g |
| It arouses real interest and leads to personal commitment, especially a willingness to spend time. | b |
| It requires more commitment on the part of the child. | c |
| There's nothing wrong with the old methods. | j |
| The teacher's preparation is different - he is the director of operations, sometimes at several different levels at once | e, k |
| The teacher is a provider of situations, surrounding the children with an atmosphere of affection and love in which they are free to work. | b |
| It requires a continual reassessment of what you are doing. | g |
| It has increased communication between teachers and technicians. | k |
| Interviewers: What advantages or disadvantages do you see in working in the "Nuffield" way? | |
| Teachers: Girls are not so happy working this way. | a, e |
| Most children have not reached the required stage of development. | c |

**L.E.A. (B)** (contd.)

**School from which response came**

Interviewer: What advantages or disadvantages do you see in working in the "Nuffield" way?

Teachers: It depends on your aims - if you want understanding then Nuffield is best, if you want a qualification use a traditional course. d
There's increased motivation, pupils are more interested. e, g
You get through much more work. e
We're too busy covering the syllabus even to try it. g
It's much harder work - each "lesson" is new c
Practical work is not necessarily better - they aren't sure what they're doing. There's chaos when pupils move school j

Interviewer: What is your opinion of the materials?

Teachers: Teachers' Guides are difficult to use - they're "airy-fairy". g
They seem easy to use. h
The apparatus is good h, g
- but expensive h
- we use it for demonstration g
I've no criticism. c

Interviewer: What about expense?

Teachers: It's the reason for our not using it. I put in an estimate for equipping for one year and was offered £80. a
We got grants - about £100 a year, and individualized learning is economical. b
Initial outlay is high and here there is no flexibility in buying to make use of cheap sources. c
There is a lack of money and resources here. f
The L.E.A. asked schools if they wanted money, but they could not afford the £1000 for each class. h
We've had a grant each year. b, e, k
There's no spare cash whatsoever. j..

**L.E.A. (C)** **Nuffield O-level Physics**

Interviewer: Is it a realistic O-level - could you use it for all who would want to take an O-level in physics?

Teachers: No - it's for top ability only - Nuffield is a 3 or 5 year course and here they don't opt for physics until the end of year 3. a
We do only chemistry-with-physics for O-level. b
We are taking part in a feasibility trial for common examining at 16+ - there's no conscious reference to the Nuffield course in this. d
We by-passed O-level g

Interviewer: Was there a need for the project? - was it worth doing?

Teachers: It has some good ideas - has made me think. e
There was no real need - we're quite satisfied that we do our best for the boys - the exam and entrance results show this. g

L.E.A. (C) (Contd.) — School from which response came

Interviewer: What chief differences do you see between the Nuffield physics and a more traditional course?

Teachers: It's more difficult than traditional, though traditional has too much maths. a
You can see what the objectives are - with traditional you have to teach it for several years before you know what it's all about. a
The objectives are different, but the exam still emphasizes content.

Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way?

Teachers: I'm happier working as I am d
I enjoy teaching by investigation - there's more interaction with the group. g
Discovery is a laborious way of establishing knowledge g
Some of the experiments are so blatantly obvious that they irritate me. e
We haven't time - they do open-ended work after school if they're interested. a

Interviewer: What is your opinion of the materials?

Teachers: The apparatus is good - we use it all and emphasize practical work. a
(No other school appeared to be familiar enough to express an opinion.)

Expense: Apart from the new school, which was equipped with Nuffield apparatus, no school had been given special grants and none, it appears, had asked for any.

L.E.A. (D) Nuffield O-level Physics

Interviewer: Is it a realistic O-level - could you use it for all who would want to take an O-level in physics?

Teachers: It does not suit our girls as well - we use years 1-3 but rewrote it. We will choose the board to give our girls the best chance of success. a
Yes, if you are convinced about its aims and have the stamina. b
For brighter, not average, pupils. e
Not for secondary moderns - I adapt it but they do the exam. c
We are doing common examining at 16+ d

Interviewer: Was there a need for the project - was it worth doing?

Teachers: Yes - it made every one stop and think and has influenced other boards. a
It has benefitted physics enormously, especially the apparatus. e

**L.E.A. (D)** (Contd.)

School from which response came

Interviewer: What chief differences do you see between the the Nuffield physics and a more traditional course?

Teachers: The Oxford Board's papers give enough recall to give confidence. a
We still write up experiments and learn. c
Oxford physics is more difficult than Nuffield chemistry. e
Nuffield physics is more conceptual. I have written my own syllabus around the Oxford Board and the Nuffield apparatus. e

Interviewer: What advantages or disadvantages do you see in working the "Nuffield" way?

Teachers: You cannot use it for girls. a, c
Some concepts are too difficult. a, e
Classes enjoy it. b, c
Some investigations do not give consistent results. c
It's wishy-washy - you could spend 3 weeks doing experiments and get nowhere. e
Preparation takes too long - the sixth have suffered. e
I did my teaching practice with Jardine and Johnston at Geo. Watson School - I thought you could teach anyone physics that way - I've lost my idealism now. d

Interviewer: What is your opinion of the materials?

Teachers: The apparatus is very good. a, e
They should not tell people how pupils will react. c

Interviewer: What about expense?

Teachers: Grants were available. a, c, e

## D. Nuffield Combined Science

**L.E.A. (A)**

Interviewer: Who would you use the materials with?

Teachers: With a little "de-mathing" we use it over the whole ability range in years 1 and 2. k
It was advertised for the top 30% so we use it for them and go one form below, giving fairly hefty Nuffield treatment. j

Interviewer: How different is the "Nuffield approach" from a more traditional one?

Teachers: It's a very practical approach which the children are subjected to - posing problems, getting them to think divergently rather than convergently. j
The contrast with my own school experience convinced me of the value of Nuffield - it just seems good sense to me - the children are much more likely to learn by experience than by being told something. j
The difference depends on how you taught before - the only difference is the money. j

L.E.A. (A) (Contd.)

**School from which response came**

Interviewer: How different is the "Nuffield approach" from a more traditional one?

Teachers: It was exciting - we came away from those early courses elated - we'd done plenty of practical work we'd never done before and now do quite happily. k
The teacher is in the class instead of being behind the bench writing on the board. j

Interviewer: What are the advantages and disadvantages in working this way?

Teachers: The Teachers' Guides etc. give you a better start than you've ever had before. The whole lay-out has simplified our administration. k
The children's response has been very good. k
Right up to the top they don't like Nuffield - it pushes them. j
They prefer to learn facts rather than do all the work. j
There's not enough guidance for back-up and consolidation. afterwards. You have to pull the stuff together for them to give them security. j
I'm worried by the way the Nuffield type course is given only to the upper streams - it's almost as if the demand they make on the apparatus means that it's not available for the slower ones. j
Projects brought science teachers together to pool ideas - this should be going on all the time. j
There's one serious disadvantage - the teacher is indispensable. j

Interviewer: What do you think of the materials?

Teachers: I've not seen better books. The pupil books are bad structurally. k
I like them - there are certain sections that state the obvious - we cut those out. j

Interviewer: What about expense?

Teachers: The grants have been generous. k, j
We think we can now manage out of capitation. k

**L.E.A. (B)**

**Nuffield Combined Science**

| | **School from which response came** |
|---|---|
| Interviewer: Would you want to use the Combined Science materials? | |
| Teachers: We have worked out our own practically based course in Years 1 and 2 and treat the sciences separately. | e |
| I encourage young teachers to devise their own course. | f |
| I introduced Combined Science into Year 1 when I came in September, as a start to Nuffield type work. | c |
| We have used it with mixed ability in Years 1 and 2 for the past 2 years. | d |
| The materials became available just when we were considering rewriting our course. | d |
| They use it in our lower school for all the pupils. | h |
| Interviewer: What chief differences do you see in working this way, rather than using a more traditional course? | |
| Teachers: It's only doing something that a lot of us had been doing before - alert schools were already using this type of teaching. | h, f |
| Some experimental techniques are different. | h |
| It has a greater emphasis on practical work - there is much that is new and exciting in Combined Science. | d |
| It's finding out through practical work - children trying to reason things out for themselves. | c |
| Interviewer: What advantages or disadvantages do you see in using this type of course? | |
| Teachers: It has problems in pupil assessment - different groups don't keep together so you can't examine them in the same way. | d |
| We haven't time to spare to make work sheets. | d |
| It fits well under the modified Nuffield courses we use later. | d |
| It leaves too much responsibility to the child, especially for the lower ability. | c |
| The children from the lower school are not afraid to handle apparatus - we are on the right path to produce good scientists. | h |
| The changeover to more traditional work in the upper school causes problems for some - they miss the informal approach - others are a bit fed up with operating Nuffieldwise and appreciate the control here. | h |
| We intend to have 2 classes in Year 3 doing extended Combined Science - it's more appropriate to their needs than the separate sciences. | d |
| Interviewer: What about cost? | |
| Teachers: I would hate to involve us entirely in Nuffield schemes as they are so costly. | h |
| You can worry too much about cost and time - we introduced Combined Science without worrying too much. | h |
| We have found Combined Science very expensive - it's bound to be when one involves children in practical work. | d |

## L.E.A. (C) Nuffield Combined Science

(HMIs recommended the use of Combined Science materials following an inspection of science in the schools.)

School from which response came

**Interviewer:** Are you using any of the Combined Science materials?

**Teachers:** As a new comprehensive school we decided to use them for Years 1 and 2. a
Yes, we have started to use it in Year 1. c
We use it for the top 60% in Years 1 and 2.
We have built a physical science course from the materials for years 1 and 2 - the biology department did not want to join in. f
No, Nuffield Combined Science is too big a jump for the teachers; they can use bits of the Scottish scheme in the old course and still have their feet firmly on the ground. b
No, we will produce our own course, drawing on Combined Science and using a topic approach. d
No - we agreed with much the HMIs said and were prepared to use it. We asked for the £2,000 we needed for apparatus, were offered £200, so had no choice. g

**Interviewer:** What differences do you see in using the Combined Science materials rather than a more traditional course?

**Teachers:** The children have a better idea of what science is about. Year 3 (after 2 years Combined Science) is more questioning and much more interested. a
There is a marked difference between Years 1 and 2 - the first year get material out and get on - the second year are relatively helpless. c
It covers more area with not so much depth. e
It still doesn't help girls to like physics. a

**Interviewer:** What advantages or disadvantages do you see in working this way?

**Teachers:** It's too superficial - nothing is done in enough depth. e
There can be too much practical - we found we had to be more formal - to sit around and discuss and pull in all the loose ends. a
It's still a bit too academic for mixed ability - the slower need to be told "read that - copy that". e
Technicians' courses don't train for discovery methods! e
We had no preparation. e
It leads to discipline problems (A lab. technician) e
It can fit into four periods a week. a
Teachers can just manage to teach across the board in Years 1 and 2 a
Specialist divisions are a very limiting factor. c
Electricity has gone down well. (girls) f

**Interviewer:** What is your opinion of the materials?

**Teachers:** I have some reservations - assessment is difficult. a
The objectives are not clear. e

**L.E.A. (C)** (Contd.)

| | School from which response came |
|---|---|
| **Interviewer:** What about expense? | |
| **Teachers:** We were a new school so had the equipment | a |
| We got £1,000. | c |
| We had a very small grant - £800 to get special apparatus - two thirds went on Combined Science and the rest on Secondary Science. | e |

**L.E.A. (D)** **Nuffield Combined Science**

(used in two schools visited)

| | School from which response came |
|---|---|
| **Interviewer:** What do you think of Combined Science? | |
| **Teachers:** It's more suitable and the children enjoy it more. | b, c |
| You get through more, but do they understand it? | b |
| You can't cover as much. It's easier when each lesson is tidily planned. | b |

## E. Secondary Science

### L.E.A. (A)

| | School from which response came |
|---|---|
| Interviewer: Who would you want to use the materials for? | |
| Teachers: A lot of it is relevant to all ranges of ability. | a |
| For those who do "core" science. | b |
| I would use it for those who do physics-with-chemistry at present and some who do physics - for the 40-70 percentiles of ability. | d |
| It could be used for the CSE band. | h |
| We have used it in planning our own general science course for CSE in bands 2 and 3. | g |
| Interviewer: Was there a need for the project? | |
| Teachers: Yes, the emphasis has been too much on the academic. | a, h |
| It's approach should be used for all- why should the brightest be fobbed off with academic science? | a |
| Yes, we are too specialized. It was needed for 50% of the 15 and 16 year olds. | b |
| Yes, there was too much watering down of academic courses for the not-so-able. | c, d, g |
| It was needed, yes, but have we time to do it? | h |
| I don't know much about it. | f |
| We have created a separate Combined Science department to look after courses for the not-so-able. | e |
| The senior schools were not ready for Secondary Science because it was called "science" and they had no science teachers, only teachers of physics, chemistry and biology. | k |
| Interviewer: What would you say were the special characteristics of Secondary Science? | |
| Teachers: It is the science of everyday life. It is relevant to these children. | b, h, d |
| It makes science meaningful. It puts the young school leaver in touch with science. | h |
| The circus method is useful. | b |
| I don't really know much about it. | f |
| I don't really know the difference between SCISP and Secondary Science. | d |
| Interviewer: What advantages or disadvantages do you see in using the materials? | |
| Teachers: The circus provides incentive to get work done. | c |
| It is easily used to prepare modules of work. | l, a, m |
| It is still too difficult for the slowest. | l |
| Literacy and recording skills are a problem - we are still searching for methods. Some class discussion is necessary. | b |
| It makes great demands on teachers and storage. | c, m |
| We have to duplicate apparatus as lab. design does not allow shifting of stuff. | g |
| Can one teacher cope? We need teaching teams. | d, h |
| We are too specialized; hopefully by this time next year we will have got our priorities right. | b |
| We had difficulty appointing staff to work even in both physics and chemistry. We're still looking for a biophysicist. | m |
| Pupils are subject minded. | |
| Pupils need separate science qualifications. | g |

| L.E.A. (A) (Contd.) | School from which response came |
|---|---|
| Interviewer: What advantages or disadvantages do you see in using the materials? | |
| Teachers: Block time-tabling makes constraints for other departments. A high proportion of CSE work is not in labs. | h |
| It's much more meaningful and relevant. | l, a |
| I just like teaching all three sciences. | l |
| Interviewer: What is your opinion of the materials? | |
| Teachers: As resource materials they're the best I've come across. | a |
| They're good. | m |
| They're difficult to wade through, but it's worth the effort. | c |
| It takes time to assimilate even one theme. | h |
| There was too much in it. We put it away, designed our own course and then looked at it for connections. | g |
| It's too much of a taught course. | c |
| It needs an organizer with ability to make apparatus. | l |
| Very good if you have storage space. | m |
| Interviewer: What about expense? | |
| Teachers: We _must_ get funds as it will be used by most pupils. | b |
| It's too expensive to go the whole hog. | e |
| You can make most things if you've got time. | c, l |

| L.E.A. (B) Secondary Science | |
|---|---|
| Interviewer: Can I ask about Secondary Science? | |
| Teachers: You can ask me but I haven't taken it seriously enough to give an intelligent answer. | f |
| Interviewer: Who would you use the materials for? | |
| Teachers: I want more time to think. | c |
| I don't know it well - I would expect to be able to use it in a general science course. | e |
| I have been using it in a course organized around hobbies in the physical sciences. (Young teacher) | g |
| I use it to pad out the Scottish Integrated Science for the non-exam people (young teacher) | j |
| I may use theme 7 and combined science for year 3. | j |
| Interviewer: Was there a need for the project? | |
| Teachers: Yes, separate sciences are not suitable for low ability Year 3. | c, e |
| Yes, schools need to get together to work out a Mode 3 on it. | f |
| I don't know it well. | c,b,d,g,j |
| It looks valuable - I've got the books, but have not used them. | j |
| We abandoned our course as general science has so low a status. | f |

L.E.A. (B) (Contd.)

School from which response came

Interviewer: What are the special characteristics that you associate with Secondary Science?

Teachers: Compared with other courses the integration is well done. a
It attacks from the same point of view as the O-level Biology. j
It gives a wider interest as the science is connected with everyday life. h
I am not familiar with it. c

Interviewer: What advantages or disadvantages do you see in using Secondary Science?

Teachers: There's not much chemistry in it. a
I'm not interested as there's very little chemistry in it. d
It has its place for that kind of child, but I'm not sold on it. e
We do the separate sciences. f
The science money is split three ways, so any integrated course has to justify use of materials in the specialist courses. k
General science has a low status. f. k
It has more advantage for the lower ability, but how do you choose who should do it? d
We don't like to separate children too soon - we use the CSE course most similar to the O-level. f, d, e, h
I see no real disadvantage - background might be missing if they wanted to do further study. h
I haven't used it so couldn't say. g
As a biologist I find the circus method a disadvantage. d

Interviewer: What is your opinion of the materials of Secondary Science?

Teachers: I have not met it. I haven't seen the materials. c, e
I have only briefly come across it. d, j
I have seen the booklets - it seems very useful material. g
I had a brief look and like the stuff. These children should have a chance to enjoy science and feel they have been successful. f
I use the themes as resources. It's a very good source of ideas. They are easy to use. b, d
They are wordy - one is being preached at when one is already converted. h

Interviewer: What about expense?

(No-one with responsibility had thought as far as this.)

**L.E.A. (C)** **Secondary Science** **School from which response came**

Interviewer: May I ask about Secondary Science?

Teachers: We've not looked at this as we run CSE groups parallel with O-level groups in the separate sciences. a

We have the books and I've noticed some of the young teachers referring to them for topics in CSE "Environmental Science". b

We've got the materials but I haven't really studied them yet. c

We bought the books after the HMI's report. I was asked to do a biology "route through", with thirty boys and nil equipment. I went back to CSE. e

We haven't got space for pupils to work so I demonstrate. e

The equipment in the energy series doesn't seem strong enough for our boys. e

I don't know it. f, g

**L.E.A. (D)** **Secondary Science**

Interviewer: May I ask about Secondary Science?

Teachers: I don't know it so well. a, d

We looked at the materials when we were faced with all ability Year 3 pupils, but decided to cut down on the unknowns and select those bits from existing courses that were suitable for the less able. d

We were a trial school for Theme 4 but the last head of science decided that it was a lot of work for no greater learning so he stopped using it and turned to Combined Science. Now that we are becoming a 13-18 school I plan to write Mode 3s in biology, chemistry and physics based on Secondary Science and allow sixth form work to develop out of these. I felt they had enjoyed Combined Science and it was a pity to go formal again too soon. b

We looked at SCISP and Secondary Science for our new Year 3 entry and chose the latter to provide a core, supplemented by work from the Nuffield O-levels. We have developed three modules on Energy, Perception and Materials, with a specialist responsible for each module, but one teacher coping with all three for a particular group. It's going very well at present and we can modify in the light of experience each term. The work sheets are off the mark for us, but we write our own. We've spent £60 on books alone - each member of staff has his own set, but the LEA has offered special grants. e

## F. Schools Council Integrated Science Project (S.C.I.S.P.)

### L.E.A. (A)

| | School from which response came |
|---|---|
| Interviewer: Who might you wish to use the course for? Could you use it for all who want a Science O-level? | |
| Teachers: I'm disappointed that it's only for the highly academic. | a |
| I would use it for every student intellectually capable of using the materials. It looks alright as a basis for A-levels. | c |
| I'm not sure how it matches with A-levels and some engineering employers insist on physics or engineering at O-level. | g |
| The students worry about its acceptability to employers. | c |
| I'd use it perhaps for able non-scientists. | h |
| The Head has asked me to look into its usefulness. | f |
| I heard it mentioned at the upper school the other day. | m |
| I don't know it. | e, h, l |
| Interviewer: Was there a need for the project - was it worth doing? | |
| Teachers: It has not met the need as it still labels kids CSE or O-level. | a |
| We need a course combining SCISP and Secondary Science for common Examining at 16+ | b |
| Integration would be good for teachers. Specialisms are too isolated. | b, f, g |
| I'm not sure. | c |
| We need both types of course - I would like to try it. | f |
| I can't see a place for it off-hand. | h |
| I don't know it, but if it's integrated people won't want it. | h |
| Interviewer: What special characteristics do you associate with SCISP? | |
| Teachers: It has included social aspects, but not enough. | a |
| The content-free examination is interesting. | b, c |
| Its method of learning - patterns to concepts. | b |
| It's more scientific than Secondary Science. | b |
| I'm not sure that it relates to society and technology as well as Secondary Science does. | b |
| Interviewer: What advantages or disadvantages do you see in using such a course? | |
| Teachers: The children could keep their options open. | g |
| Who would teach it? | a |
| People are specialists at heart - there would be a rapid turnover of staff if I decided to introduce it. | g |
| It would be in competition with specialist courses. | f |
| There is no equivalent at CSE. | b |
| You can't use it with mixed ability. | b |
| It does not supply the kind of qualification that kids want. | g |

| L.E.A. (A) | School from which response came |
|---|---|
| **Interviewer:** Have you seen any of the materials? | |
| **Teachers:** I have seen all the trials stuff. | a |
| I've seen part of it. | b, c |
| No. | d,e,f,g,h |
| (No teacher had any opinion on expense.) | |

| L.E.A. (B) S.C.I.S.P. | |
|---|---|
| **Interviewer:** May I ask about SCISP - the Schools Council Integrated Science Project? | |
| **Teachers:** I don't know of this at all. | g,h,j,b,c,d,e |
| Oh yes - that must be the JMB 2 O-level science course | g |
| We had some information last summer, but I shelved it. | e |
| I have heard of it - the LEA man seemed to push it. | j |
| I have heard about it,at the one day ROSLA Conference. | k |
| I've read about it recently to prepare members of the department for interviews - I'm sending one on a course to find out more. | k |
| I would have gone to the Sheffield Conference if I'd known about it. | f |
| **Interviewer:** Would you consider using it? | |
| **Teachers:** I've seen some of the materials and it didn't appeal. | a |
| I've come across it, but not many of our children would have the ability to cope. | b |
| We would not have large enough numbers as we would still have to run separate science groups. | c |
| We haven't got around to that lot yet - it's an added burden - we may use bits. | d |
| I don't know it, but I'm interested in integration - I'd like to integrate science and maths. | c |
| I'm not sure if it has a place - you lose something in integration - it's easier to teach separate sciences. | e |
| I don't see the point - the biology curriculum has changed so much it's already related to physics and chemistry. | e |
| I'm not particularly interested in the integration of the sciences, more in their segregation. | j |
| I'd heard about it and said I was interested and the Field Officer let me have some materials over a week-end - but I didn't like it - I don't really know why, as I approve of general science, perhaps because they cut down time for science. | d |
| I've heard it's not been well-received - too much biology in it. | j |
| Nobody abandons all this (pointing to a fat syllabus file) just because a new course has come out. | f |

### L.E.A. (C) S.C.I.S.P.

School from which response came

**Interviewer:** May I ask about SCISP?

**Teachers:** I don't know it. f, g, d

**Interviewer:** Would you consider using it?

**Teachers:** It would be difficult as we'd need to staff single O-levels as well - only about 10% of our pupils would need 2 O-levels. a
It sounds a good idea. b
We plan to use it in 1974 when our Combined Science pupils are in Year 3 and develop a CSE Mode 3 on it. c
We're going to use it as a dissemination school - we were wasting our energies doing 3 separate sciences - this will help us work together and pool our resources. e
I like the social emphasis. e

### L.E.A. (D) S.C.I.S.P.

**Interviewer:** May I ask about SCISP?

**Teachers:** I don't know it. c
I am reading the materials now and would like to go on a course. b

**Interviewer:** Would you consider using it?

**Teachers:** Perhaps - in the future - for the one-science girls. a
I don't think it has enough chemistry in it for A-level preparation. a
I am not much in favour - one teacher would have too many background gaps. d
I want to wait to see all the materials first. d
Could they do A-level after it? d
We did go into this very carefully - the LEA asked if we'd be a trial school - the money was attractive and we liked the innovation in SCISP - the organizing concepts, social emphasis etc. but the materials were not available in time and they appeared too sequential to modify. We'd need to identify an elite band when the pupils came to us at 13 - we didn't want to do this - we wanted to work across the whole ability range for them to find their own feet. e

## (iv) Decision-making

The following reports of decision-making are structured on the assumption that the elements contributing to a decision to use a certain course with a particular group of pupils in a school may be analysed into three levels:

(i) the LEA and local area in which a system of communication and support, together with pressures and constraints, operates;

(ii) the SCHOOL with its particular organizational pattern and assumptions about its role;

(iii) the TEACHER with attitudes and behavioural characteristics which may influence decisions.

This was essentially an illuminative, exploratory study directed towards identifying the contributory elements and their inter-relationship in the process of decision-making in the schools.

(i) The communication and support system, with attempts to quantify it for science education, is discussed elsewhere in the report, but a brief summary of the characteristics of each case-study LEA precedes below the reports on decision-making in the schools units area.

(ii) No attempt was made to enquire in detail into the organization of the school and there was rarely time or opportunity within a visit to talk for long with the head teacher. However, where relevant factors have emerged these have been recorded.

(iii) The cumulative results of our enquiries has been to emphasize the importance of the teacher, and particularly the head of a subject department, in decisions that are made in the use or non-use of curriculum materials.

### Characteristics of teachers:

From the following reports five characteristics of teachers have been selected, tentatively, as influencing the use of project materials by themselves or by others:

(a) EXPOSURE TO COMMUNICATION.

The teachers who appeared to have a relatively high familiarity with projects were often those who played an active part in personal communication activities in an area. This characteristic may be in some ways parallel to the "cosmopolitan" dimension of some studies.

(b) OPENNESS TO CHANGE.

This characteristic became apparent in a teacher's comments about curriculum projects and the changes that had been made in the courses for which he had responsibility.

(c) INDEPENDENCE.

This characteristic described the behaviour of some teachers who appeared to act independently of the prevailing climate of opinion, some to bring about a change, others to resist a change.

(d) INITIATIVE

This characteristic may be related to INDEPENDENCE, but whereas the latter may be exercised by not making a change when others around do so, high INITIATIVE requires a teacher to have made moves himself associated with changes or developments.

(e) LEADERSHIP

This characteristic was defined by the apparent effect the behaviour of its possessor had in influencing the behaviour of others in a direction defined by common objectives.

It is possible to postulate that an innovatory person is likely to be placed high in characteristics (b), (c) and (d). If the concept of innovator is related to the overall direction of change in the relevant milieu, then the innovator will be high in (a). If the innovator is an isolate he will not be high in (e) but if parallel changes made by others may be traced to him he will be high in (e). A teacher high in(a) and (b) but low in (c), (d) and (e) will quickly adopt a change proposed by leadership that he acknowledges.

A. L.E.A. (A) County authority, size category LARGE

Special characteristics:

Comprehensive system of schooling in operation for some years, with upper schools (14-18) developing out of grammar schools, and the early leaver remaining in the 11-14 schools in some areas. A feature of L.E.A. policy has been to establish new schools directed towards the development of resource-based learning and individualized learning within more democratic modes of organization.

Full-time science adviser since 1966 with full-time teacher adviser for environmental science since 1967.

Planned financial support since 1967 to introduce Nuffield science courses into secondary schools.

Trial schools in Nuffield O-level Biology, O-level Physics, Secondary Science, Combined Science, A-level Biological Science, A-level Physics, but not in O-level and A-level Chemistry.

"Key persons" (teachers) involved in early curriculum development in biology and physics, but not in chemistry.

School of Education with a special interest in curriculum development as a whole and in the science education, but with an emphasis on academic courses.

L.E.A. policy (decision originally at CEO level) is to operate Mode 3 CSE courses.

An informal group of physics teachers had existed in the early sixties to discuss the teaching of "modern" physics.

Communication channels supported by University Departments and the School of Education and examining are mainly within the separate sciences.

Communication channels for high schools are mainly via the linked upper school.

At L.E.A. level in recent years several attempts have been made to involve upper schools in the use of Nuffield Secondary Science.

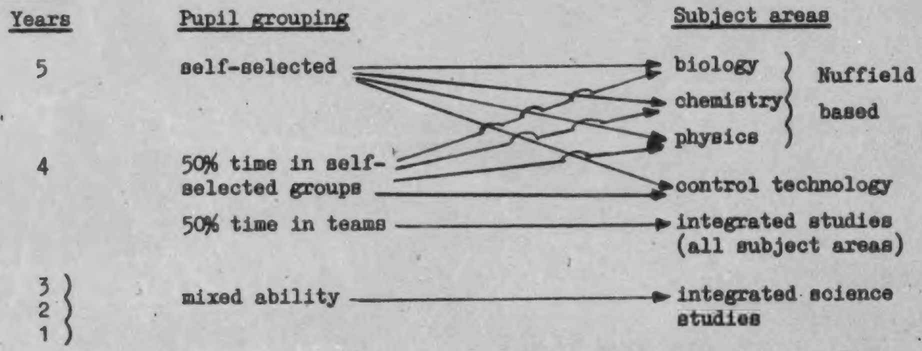
School Aa

1000+
mixed comprehensive (11-18)

New school, opened 1970. It was organized on democratic lines - the staff had no special staffroom, but made use of "coffee bar" areas together with the pupils. This produced some inter-staff communication problems.

The school organization was still fluid. At the time of interview it expected to become severed from its "high school" in the near future and to expand the 13-18 range. Contacts with the school tended to be initiated from outside - it had many visitors.

Science


Years
Pupil grouping
Subject areas
5
self-selected
biology
chemistry
physics
Nuffield based
4
50% time in self-selected groups
control technology
50% time in teams
integrated studies (all subject areas)
3
2
1
mixed ability
integrated science studies

The science staff used one large prep. room for 'brew-ups' - much informal, as well as formal, discussion took place. Interaction among staff and between staff and pupils was highly sensitive to dissatisfaction. Several initial procedures had been changed:

Years 1 and 2, an integrated course, developed from Nuffield separate science materials, was initially handled by teams, using the central large laboratory areas. This was abandoned when the original teams broke up, new ones were found not to work together so well and the newly-appointed Head of High School Science "did not see this way of working".

Year 3 had separate courses based on Nuffield biology, chemistry and physics, but staff discontent was expressed and a new course, currently meeting with high approval, has been developed, drawing heavily upon Nuffield Secondary Science materials. This was an intra science decision.

Year 4 - dissatisfaction with response of students to the courses offered in all subject areas led to the trial of interdisciplinary enquiry in teams for 50% of the time. The biologist was working in one team and all were beginning to call upon the help of specialists. This was enabling the science department to become more integrated than formerly into the school as a whole. For the remaining 50% of the time the pupils were able to involve themselves in further specialist studies. Some chose a science and some could proceed to an examination - O-level or CSE Mode 3.

Year 5 continued Year 4 specialist studies. Individualized learning was used throughout. Pupils were not divided into separate "O-level" or "C.S.E." groups.

The decision to use Nuffield separate science courses, but to adapt them for individualized learning and modify for a CSE Mode 3, was made by the Head of Science and Head of Physical Science in the summer term before the school opened. Factors contributing to this were: some pupils would need an O-level; Secondary Science had not been published; at the time a Mode 3 O-level was not a real alternative; the staff were familiar with the Nuffield O-level courses.

At the time of interview few continuing contacts had been made with the newer school (Ab), developing along the same lines.

## Teachers.

**Biology.** The head of department was not interviewed - he seemed to be somewhat separate from the science group and was operating within one of the Year 4 teams.

**Chemistry.** The chemist, head of physical science, had many communication channels, including publishers, and science education groups in the United States. He demonstrated a high familiarity, in discussion, with most published projects. He was perhaps the member of the science team most sensitively aware of problems. He had been instrumental in the changes in Year 3 (see later). He would like to develop an O-level course firmly based in the social "relevant" aspects of science, in the form of modules, with choice, as a *core* to which further specialist studies could be added by those who were interested. He was disappointed that SCISP was so orientated to the academic child.

**Physics.** The senior physicist was the head of science. He was a man of high independence and drive, perceiving few limits to his field of activity. He had entered school work via industrial experience, part-time degree and further education work - he appeared to be an efficient organizer, delegating responsibility. He was planning a residential conference at the school for all who were interested in individualized learning[1] (initiating contacts from the school, but rather special public contacts).

Two young members of the science staff interviewed were obviously recruited for their flexibility, enthusiasm and commitment to the philosophy of the school.

## Decision to change year 3 work.

The head of physical science reported:

> "Last year we each had one double period a week with the third year - physics, chemistry and biology. I took three third year groups. The kids just couldn't get anything done - we couldn't get to know them and it was difficult to give them any choice over what they were doing as we couldn't carry in our minds options for 90 kids. We kept saying we would *have* to do something about it next year - we were always talking about possible alternatives - moaning over coffee. I wrote a paper for a Science Department meeting on what I felt the grumbles were and the possible solutions - just got it down on paper:
>
> 1. a term each in biology, chemistry, physics
> 2. six weeks in each and rotate,
> 3. team teaching in the central area,
> 4. have one group for the whole year's work,
> 5. look at third year team and say what is each happy to do.

---

[1] This has since taken place and a standing conference of interested persons has been formed, with the publication of news sheets and the sharing of information and resources.

I pointed out the advantages and disadvantages as I saw them of each alternative. We discussed it at meetings and came up with a consensus on (5). Each team member agreed to cover two specialisms, so we would keep a group for two-thirds of the time.

I was detailed to put this into operation and negotiated with the person doing the time table so that teams would work together. The final time table wasn't exactly what we had wanted, but near enough, so we went ahead with preparation of materials. Last term I kept a close watch on what was happening, going along saying what's available, what are you doing? What are the problems? Are you transferring? It became clear that people were keeping their own kids - it was much better to keep those you know than to take in other people's - we just made the effort to make ourselves familiar with other people's work. Now everyone is saying 'Aren't the third year fantastic this year' - we know them - know their problems."

The change involved here was from specialist-taught separate courses in biology, chemistry and physics to a course providing experience in all three areas, using materials prepared by specialists, but directed by a single teacher.

### Context.

(1) A school where the explicit objective was the development of the individual child.

(2) A science department of subject specialists.

### Origins of change.

The "before" situation of separate sciences, separately taught, arose from (2). The attempt to provide for (1) led to dissatisfaction, as the fragmentation and spacing or contact time meant that the needs of the individual child were not being met.

The "after" situation was not planned directly: a compromise, taking account of the insecurities involved in working outside a specialist area and requiring special timetabling, was put into operation.

The rewards of the new arrangement - pupil response and the gratification experienced by specialist teachers when they discovered they were able to operate successfully outside the limits of their specialism - led to the full change being accomplished.

The change has enabled the use of Secondary Science materials.

### Organizational elements involved:

(1) the common meeting place (prep room) at which grumbles were voiced,

(2) the regular official meetings of the science department,

(3) the right of a member of the department to submit a paper,

(4) the discussion and acceptance of the consensus solution,

(5) the appointing of a co-ordinator to put the plan into operation,

(6) the negotiability of time-tabling.

Other elements:

(7) the climate of the school that accepts change is necessary,

(8) the initiative of a senior member of the department,

(9) the flexibility of the members of the third year team.

This change has taken place in a highly facilitating environment in which the chief constraint to the ability to respond to perceived pupil needs is likely to occur through personality clashes and not organizational constraints.

## School Ab.

1000+
mixed comprehensive (11-18)

New school, opened in 1971. Organization - fluid: they were still seeking the best formula for democratic discussion and decision-making.

Subjects such as salaries, recruitment of new staff, division of capitation were discussed in the open. The sorting of these out in a roughly equitable fashion was said to be slow, painful and sometimes inefficient, but on the whole worth it.

The school was organized with a principal and two deputies, It had two standing committees: academic and pastoral, with elected chairmen.

Science department: specialisms not highly insulated.

Organization

| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5)<br>4) | one science option → | environmental science |
| | more than one science → | biology and/or chemistry and/or physics |
| 3)<br>2)<br>1) | mixed ability → | integrated course |

Years 1-3 - fluid course - individualized learning, team teaching, investigational.

Years 4 and 5: within options pupils worked in mixed ability groups and selected an examination at the end of the course.

Teachers

Biology: The senior biologist was head of department. He made high use of consultation in his department in the preparation of individualized learning materials and in the discussion of wide implications of science education. He had concentrated initially on the development of work for the 11-14 age band. He did not use Nuffield biology, as he found Joint Matriculation Board more adaptable to mixed group working. SCISP was rejected for the same reason. He expressed concern that the education and experience of his highly qualified staff had not equipped them to meet the needs of the majority of children. He was appreciative of the skills and experience of the more junior teachers and had delegated responsibility for the Environmental Science course to the non-graduate (below).

**Chemistry** (not interviewed) - used Nuffield course.

**Integrated science** (ex policeman, non-graduate) in charge of environmental science course. He was widely read in popular science. He was very familiar with Secondary Science materials and was experimenting with class organization to achieve greater pupil satisfaction and learning.

**Physics** (Engineering Science graduate)- in favour of integrated science courses. Used Nuffield physics.

## School Ac

1000+
mixed comprehensive (14-18)

The school was established on the present site in 1969 with grammar school pupils and staff from a neighbouring small town as a nucleus. Building was still continuing at the time of the visit.

A curriculum committee, consisting of deputy principal and faculty heads, had recently been formed to co-ordinate the work of departments.

A foundation course in humanities had been designed for Year 4, with the possibility of continuing into Year 5 with Mode 3 examinations in both CSE and O-level GCE.

### Science faculty.

Science and mathematics were sited together as an integral part of the main school building. The Head of Science was a chemist, heading a team including Heads of Mathematics, Physical Sciences and Biological Sciences. The last two, together with the Head of Science, were new to the school in September 1972.

The science courses had been of a rather formal nature and no Nuffield materials had been in use. The coincidence of new appointments had made possible rethinking of the work of the department and a foundation course in science was under discussion. The incumbents of two of the posts of responsibility were still on the staff, heading up pastoral units. An unusual feature of this school was the high interest shown by all the science staff in integrated science courses for all pupils.

### Present structure of courses:

| Years | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5)<br>4) | O-level | → | biology and/or chemistry and/or physics |
| | CSE (Mode 3) | → | biology and/or chemistry and/or physics<br>(environmental science |
| | non examination | → | (rural studies |

### Possible future structure

| Years | Pupil grouping | | Subject areas | | |
|---|---|---|---|---|---|
| 5 | self-selected "module" groups | → | SCISP/secondary science modules | → | GCE or CSE |
| | | → | "interest" courses | → | no exam |
| 4 | large groups (team teaching) | → | Foundation Course (integrated science) | | |

Teachers

Biology: The head of biology had moved from a school in Hertfordshire and had followed one year of the Chelsea M.Ed. course. He had been involved in Nuffield A-level Biology trials and was using Year 4 O-level materials with present groups. He had already established some communication links with other teachers in the area and appeared ready to consider innovations in curricular organization. He was not very familiar with Nuffield Secondary Science materials.

Chemistry: The senior chemist was Head of Science and Mathematics. He displayed an open, thoughtful, cautious approach to problems. Illness within the department had prevented him from developing plans as quickly as he had hoped. The delay in the publication of Year 4 of SCISP had also caused problems, so that established courses were continuing. He was negotiating with feeder high schools to use SCISP Year 3, and had encouraged the participation of a junior member of the department in the design of a Mode 3 CSE environmental science course (with school Ab). Secondary science materials were used in this course.

Physics: The head of physical sciences had moved to the school from school Aa. He was currently attending Nuffield A-level Physics course prior to its introduction into the school. He was familiar with the writings of Eric Rogers but was critical of the divorce of Nuffield O-level Physics from everyday life. He was interested in "Control Technology" and would like to develop it in the school.

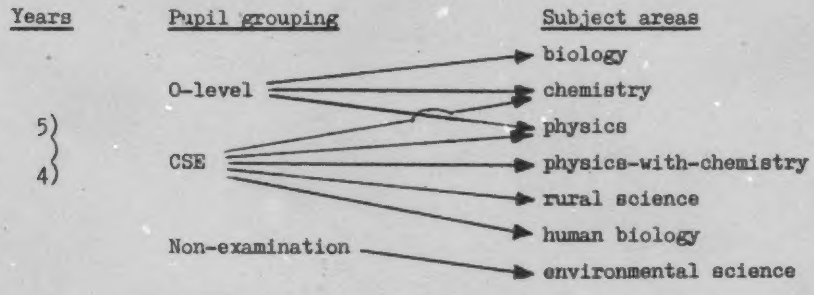
Physical Science: The teacher responsible for Environmental Science Course appeared to show independence and initiative in the development of the course. He was concerned that the requirements of even a Mode 3 examination constrained the kind of development, with open choice of modules, that he would like to see for the less able.

School Ad 1000+ mixed comprehensive (14-18)

The headmaster claimed that he did not believe in things being too organized and therefore had not created an academic board or curriculum committee.

Science

Three separate departments existed: Biology, Chemistry, Physics. Physics and chemistry collaborated to run a physics-with-chemistry course for the less able. When a newly-appointed member of staff wished to develop an environmental science course he negotiated directly with the headmaster for space and equipment in the biology department.



## Teachers

Biology: Head of department had been involved in Nuffield trials and had used the materials "as they came along". He had taken part in the early development of a grouped schools Mode 3 CSE on the Nuffield materials. He was an organist and closely involved in all the music activities of the school.

He and his pupils had become discouraged by consistently low pass rates in the Nuffield O-level examination and so he had decided to give fourth year pupils choice in deciding whether to follow a "Nuffield" course or the J.M.B. The choice was presented in terms of investigating and thinking for themselves, or learning and understanding material presented to them. (In 1972/3, of the 42 choosing to do O-level biology, 15 chose a Nuffield course and 27 the J.M.B. - these were mostly girls). The underlying assumptions here were that more pupils would achieve an O-level pass using the J.M.B. materials and appropriate methods than with the Nuffield course and examination, that biology was a vocational subject for girls, so that as many as possible should achieve a pass, and that hard work should be rewarded. He saw as possible reasons for "failure" -

1. Country kids may be a bit slow -
2. they were conditioned to learn and regurgitate in all other subject areas,
3. it was difficult to tune them into the kind of questions Nuffield sets.
4. Perhaps the teaching was at fault.

He was still intellectually committed to "Nuffield" and hesitated to fault the project.

Chemistry: The head of chemistry appeared to be somewhat of a recluse, not mixing with his colleagues within the school or in the area. He did not use the Nuffield materials, but had recently introduced into the course some project work that he was anxious to display.

A young chemist (probationer) working in the department was articulate about "keeping his boundaries open" in a school in which the specialisms were highly insulated. He was familiar with the Nuffield O-level materials in chemistry and Michael Shayer's work on Stages of Development and the Nuffield course.

Physics: This department was sited in a new block, with art and home economics and away from the other sciences. The Nuffield O-course had been in use one year when the head of physics was appointed. He continued its use and introduced the A-level course. His enthusiasm for the new materials was tempered with caution arising from a need to match them to the potential of his situation.

He knew of the work developing in Secondary Science in the feeder high schools and hoped to develop work from it for CSE. He was interested in SCISP materials, being aware of a need to modify these and was prepared to tackle a Mode 3 adaptation. He was planning to attend the area SCISP Conference the following weekend. His young assistant was Chelsea-trained and enjoyed working in the department.

School Ae

800 - 1,000
mixed comprehensive (14-18)

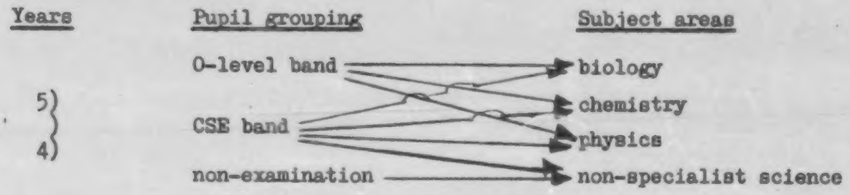
Special characteristics:

Academic board formed from headmaster, 3 deputies, 8 faculty heads. Headmaster very conscious of managerial role.

Science faculty: 4 departments: Biology, Chemistry, Physics and Combined Science.

The school draws pupils mainly from professional, middle-class homes.

Science organization:



There was high autonomy of separate science departments. A separate Combined Science department, within the science faculty, had been created to service integrated science programmes. O-level work was excluded from this department. The Head of Science had held this same post in grammar school days.

Teachers.

Biology: The head of department was a Nuffield enthusiast, involved in trials of O and A level materials. He was highly aware of the objectives of the projects, articulate and critical. He expressed no doubts about the superior quality of the experience that the Nuffield course offered pupils. Both the headmaster and the head of faculty expressed doubts about the possibility of maintaining the financial support for the Nuffield Biology course in the school at its current level after special grants had ceased.

Chemistry: The head of science was in charge of chemistry courses in the school. He was satisfied with the changes that had occurred in the examination board syllabus he was using, describing it as "deliciously modern". He claims that he might have used the Nuffield course if the other board had not changed, but he was irritated by the perceived constraints of it as a "package" course that would prevent him from exercising his "professional expertise".

Physics: (not interviewed). Junior in department was a Nuffield enthusiast - had requested use - apparatus had been ordered using County's final offer, but teacher now was leaving. Department might still do Nuffield physics.

Combined Science: Head of department appeared to have less autonomy than other departments in faculty. He had exercised independence in drawing on various sources, including Secondary Science, in designing the course.

School Af. 1000+ Mixed comprehensive (14-18)

This was an early comprehensive, with current accommodation problems for science. Only the head of science was interviewed. He had only just been appointed - an internal promotion - and this had obviously affected his communication activities: he had attended the ASE Conference for the first time that year. He was very interested in sailing and ran a club for the pupils. Weather permitting he would fly twice a week and reported that any course he chose to attend would be in this connection.

No Nuffield courses had been in use in the school until September 1972, and then, largely as a result of the county's grant offer, they had decided to use the biology and physics materials to examination, but not the chemistry. The head of science, a physicist, claimed to have been carried into it by the enthusiasm of a young colleague who had left to start a family. However, she had been replaced by a man who had taught Nuffield physics in another county school, so the support was still there.

The headmaster had passed on to him the information received by the school about SCISP and the Area Conference, asking him to "look into" it. He expressed interest in an integrated course at this level, referring to "artificial divisions" in science and his own ignorance of other areas, but saw accommodation problems preventing the development of further courses. He knew little about Nuffield Secondary Science.

School Ag. 1000+ Mixed comprehensive (14-18)

This was the largest of the county upper schools. The principal is an ex-science adviser, but takes the line - "what was possible in my day is possible now" when faced with requests for smaller groups and increased resources. He sees that the spread of curriculum development projects to other areas of the curriculum has increased the demand on capitation in these areas in direct competition with science.

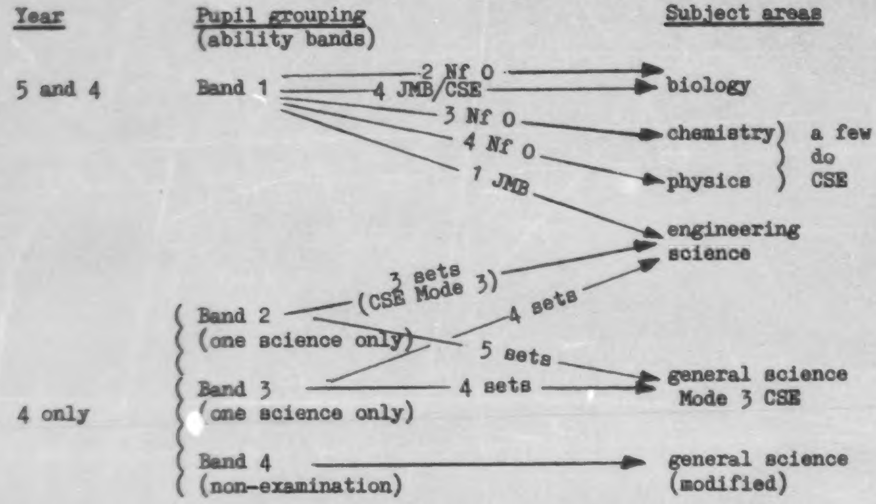
Science department

Science teaching in this school has traditionally been investigation-based, with a concern that pupils experience enquiry across the whole range of the sciences. There was an unexpected affection for the "old General Science".

In the sixties, three staff had been closely associated with the development of Nuffield O-level materials. The two physicists had moved on to work in P.G.C.E. university courses while the biologist had worked in the Nuffield A-level Biology team before moving back to the local School of Education.

The science courses offered to Year 4 pupils had recently been modified to include a Mode 3 CSE General Science course.

## Science organization


Year
Pupil grouping (ability bands)
Subject areas
5 and 4
Band 1
2 Nf O
4 JMB/CSE
3 Nf O
4 Nf O
1 JMB
biology
chemistry
physics
a few do CSE
engineering science
3 sets (CSE Mode 3)
4 sets
5 sets
4 sets
Band 2 (one science only)
Band 3 (one science only)
4 only
Band 4 (non-examination)
general science Mode 3 CSE
general science (modified)

The need for the General Science course was seen to arise from the restriction to one science option operating in Bands 2 and 3. The idea was suggested by the head of science and was eventually accepted by all members of the department. He also suggested the use of Secondary Science materials for the course. A biologist assumed responsibility for its development and it was currently being taught by biologists. The head of science hoped to persuade others to participate in following years but, he claimed, teachers and pupils are "specialists at heart".

The biology department entered only the brightest pupils for the Nuffield examination, having followed a separate course with them. Two groups were selected from the high school reports for this purpose. The remaining four sets in Band 1 followed the course for the JMB examination with the weaker ones (about one third) entering the Mode 3 CSE. This latter examination was used by other schools for those who had followed a Nuffield course. Pupils' need for a qualification and the perceived greater facility of the JMB examination were the underlying reasons for this pattern of courses. The high use of the engineering science courses and examination also illustrated the high sensitivity of the science department to social, vocational pressures.

### Teachers

Biology. The head of science was originally a geologist, but was operating as a biologist. He was familiar with all the published Nuffield materials and in the biology course claimed not to have referred to the texts for some time. He felt free to modify the materials for his own course. It was not possible to decide whether the vocational claims for science education that he firmly expressed originated initially from his own thinking or were a part of the orientation of the whole school in the community, but he was not prepared to act contrary to these claims.

Chemistry. The head of chemistry reported that he had been on the staff during the trial stage of the project, but the then head of department had not wanted to be involved with it. He had introduced the materials for all those doing an O-level course on being appointed to the senior position. He had not been influenced by the practice in biology of entering only the most able and found an increased pupil interest and motivation in the use of Nuffield materials.

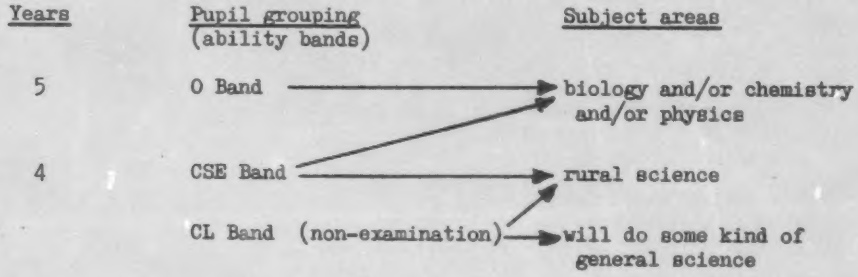
Physics. The head of physics was highly aware of recent developments in physics education. He used Nuffield physics materials for all O-level candidates. More girls had chosen to do physics recently. The physics department was separated from biology and chemistry in a "Design and Engineering" block. This was seen as an obstacle to the further development of integrated courses.

### School Ah. 1000+ Mixed comprehensive (14-18)

The school was founded as an early grammar school. It was the only school visited in the area in which the wearing of a uniform was apparent. The staff dining tables were separate from those of the pupils.

### Science

Physics and chemistry were still in the original laboratories. Biology was in a new block that had already become too small. Much CSE was taught in ordinary classrooms. Physics was due to move to a new design block in two years. One physics laboratory would then be converted for general science work, while the other would be used for chemistry. The departments operated quite independently of each other.


Years
Pupil grouping (ability bands)
Subject areas
5
O Band
biology and/or chemistry and/or physics
4
CSE Band
rural science
CL Band (non-examination)
will do some kind of general science

### Teachers

Biology. The head of biology was also the careers master. He had been on the staff for some years and was recognized as a leading naturalist in the area. He gave the impression of awareness, vigour, and decisiveness.

He had been in touch with school Ag at the trial stage of the Nuffield O-level Biology and was ready to introduce the course when the materials were published. He had developed some materials in ergonomics for another project. Separate botany and zoology were still offered in A-level work.

He had at one time entered four groups in Nuffield O-level Biology, but now selected on mathematics ability and entered only one group. Reasons given:

> Some pupils did not get a pass when he expected them to do so; girls especially did not enjoy the course - "they prefer something that is cut and dried rather than open-ended"; "From a science point it is better if they think, but from parents' point of view - for a career - they need an O-level. If a child has a better chance of getting an O-level with another exam it's my job to see he or she gets it."

The headmaster was aware of the popularity of the biological sciences in the school.

Chemistry. Head of chemistry was also head of science. He was changing to start use of Nuffield O-level chemistry in 1973. Reasons: the Nuffield course had been "sold to the high schools"; he had been offered a £500 grant to equip for fourth year work and expected not to receive this if he did not use the Nuffield course; he accepted the word of others that it was worth trying. He might follow biology and enter only one group for the Nuffield exam.

He did not know how options operated in Year 4, nor if all pupils were required to include a science in their choice.

Physics. The head of physics was a woman who had been appointed two years previously. At her appointment it had been made clear that she would be expected to use the Nuffield materials eventually. She did not know them well at the time of interview.

She saw that the decision had been made at the science adviser level - the high schools had been doing the first three years of the O-level course on the understanding that this would continue in the upper school. She had had a grant for £900 to equip for Year 4 and was using the apparatus in a traditional course. She would probably use the full course only for the most intelligent. A member of her department reported that she was reluctant to change.

The only teacher to know much of the Nuffield Secondary Science materials was a young physicist, though the head of biology had used theme 3 in ergonomics work.

B. L.E.A. (B) County authority, size category MEDIUM.

Special characteristics:

Separate boys and girls grammar schools - one a very early foundation - existed only in two towns in the county. L.E.A. policy had been to establish "General Secondary" mixed schools, following the 1944 Education Act. These had slowly been developing into comprehensive schools with a plan to complete reorganization to a fully comprehensive system by September 1973. There was some doubt as to whether approval would be given to change the grammar schools.

Most of the general secondary schools had developed without the most academically successful pupils. Some were 11-16 schools only, most had relatively small examination groups and relatively small sixth forms.

The schools were scattered through the county except in areas bordering on two cities situated at opposite ends of the county, on its borders. There was a Department or Institute of Education in the University in each of the bordering cities. Separate Biology, Chemistry and Physics Teachers' Centres were associated with one of the Universities. Each city had at least one College of Education active in science education.

In one of the city L.E.A.s bordering the county there was an active interest in, and practice of, mixed ability teaching groups.

Two County Inspectors were responsible for all the work done in schools of all stages and the supervision of probationary teachers, but not the appointment of teachers. These two officers seemed well aware of the problems and strengths of individual schools and there was evidence that one, with a mathematics background, was acting as a communication channel in spreading information about curriculum development materials in science, through his contacts with probationary teachers and attendance at meetings of the county science teachers' association.

A locally-based Schools Council Field Officer was active in the area and known to several of the teachers.

The L.E.A. response to the curriculum development movement was to set up Curriculum Development Groups in each subject area. The Science Group had operated by heads of science, in alphabetical order, assuming the position of secretary for an academic year to co-ordinate activities. The level of activity appeared to depend strongly on the characteristics of the current secretary, his perception of curriculum development and the role that a group could play in this.

Financial support for curriculum development in the L.E.A. was limited, but any school appeared to be able to depend on steady support of £100-£200 a year for the development of new science programmes if they made an acceptable case for requests.

School Ba    size: 400-600,    girls' grammar    (11-18)
(In latest reorganization plan it was destined to become a girls' comprehensive, 11-18.)

The school was founded at the beginning of the century. The buildings, rooms and equipment were clean, tidy and excellently cared for.

## Science.

This was presented throughout the school as separate subjects, although one teacher might teach all three to one class. After choice at the end of Year 3 the subjects were quite separate. All staff had attended in-service Nuffield courses at the University centres in the late sixties. They had recently visited several of the general secondary schools to observe children working and discuss approaches with staff in anticipation of the wider ability entry they were due to receive in 1973.

## Present organization.

| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5 )<br>4 ) | O-level groups → | biology and/or chemistry and/or physics |
| 3 )<br>2 )<br>1 ) | class groups (unstreamed) → | biology and chemistry and physics |

## Teachers

Biology. The head of biology was also in charge of careers work in the school. Nuffield biology materials were used in Years 1 and 2. Expense of fresh materials was said to prevent use of some pupil investigations.

The girls who chose to do biology in years 4 and 5 followed a more traditional course. They were said to enjoy it and to get good examination results. Because of this it seemed that the head of biology had not seriously considered the use of the Nuffield project to examination.

Chemistry. The head of chemistry, also head of science and deputy head, was close to retirement. Nuffield chemistry materials were used with the London examinations at O and A level and were judged to be an excellent resource by the head of chemistry. She had made a point of looking at SCISP materials, made available at a meeting, but had been put off by them. She did not seem able to pin-point her objections, but was unlikely to pursue the materials further. She appeared to have a quite detailed knowledge of Nuffield Secondary Science materials. The use of these and Combined Science was being considered for the future.

She had given a great deal of thought to the kind of work and organization appropriate to a comprehensive school. Together with her colleagues she had visited school Bf, to see mixed ability groups working in years 1 and 2. She reported that they would probably broadly band for ability in science work.

Physics. The head of physics had asked for funds to use the Nuffield physics materials after attending an early course, was offered £80, so bought just one kit and has added others since. She claimed to use guided pupil investigation as basis for learning and emphasized girls' need to handle equipment to develop confidence.

Any decisions made in the science area to accommodate future changes in the school intake will be after much questioning and consultation. Excellent relationships appeared to exist between members of staff in the department.

Three basic reservations about possible directions of change were:

1. mixed ability groups taught by those experienced only in teaching the more able might operate to the disadvantage of the less able,
2. individualized learning required more resources than were available to them and led to loss of social experience,
3. investigational methods, as embodied in some of the Nuffield materials, failed to provide enough feed-back to girls to enable them to operate with confidence.

School Bb size: 400-600, mixed, general secondary to comprehensive 1973 (11-16)

The school was in a relatively isolated small holiday resort. Employment was mainly provided seasonally by the holiday trade or on the land behind the town. Traditionally many boys joined one of the services.

The headmaster (new to the school two years ago) and the deputy head (also head of science) were active members of the local community. They were both committed to a philosophy of education that required the child to take responsibility for his own learning and involved mixed ability groupings and interdisciplinary enquiries. The assessment of the child was made against his own potential, as judged by his teachers, and not competitively with others. The headmaster had recently stopped the practice of providing lists of examination successes to the local press, as he judged that this inflated the importance of what was only one objective of the school over others which were less directly measurable. There was a group of teachers within the school who were not fully in sympathy with this philosophy. The staff groupings were not therefore by age or by subject, but in terms of their support for what may be described as "progressive" and "traditional" orientations to education.

Science

The department was staffed by two teachers: the head of science who initially qualified as a physicist, and a young biologist.

| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5<br>4<br>3 | mixed ability, individualized learning | O-level or CSE in physics physics-with-chemistry, biology or General Science |
| 2<br>1 | Year groups team teaching | mathematics and science enquiry |

Teachers

The head of science had been at the school since it opened in 1961. He had a high familiarity with all the published Nuffield materials relevant to the 11-16 age range. He felt free to modify the materials to suit his particular situation and appeared sensitive to new ideas in education and ready to give them serious consideration.

He reported that he had been convinced by discussions at the "local" University in 1965 that streaming was unnecessary. The publishing of the Nuffield materials in 1966 provided "ideal materials" for individualizing learning. Packaged kits were prepared, some available for home use. To meet demands for laboratory use he had opened the laboratory one evening a week. Some past pupils attended these sessions. The L.E.A. had been supportive, providing small grants each year to provide extra equipment, and "individualized learning is cheap".

The decision to integrate the maths and science teaching in the junior forms had come about by the response of the two departments to the headmaster's request to the staff in general that they "look at integration". These two departments (staffed by teachers with similar educational orientations) met together several times, discussed what reports they could find of other attempts, decided they would have to learn by doing and went ahead with Year 1. Results were encouraging and they were discovering what was feasible so they modified for the following year and extended to Year 2.

School Bc size: 400-600, mixed comprehensive (1970) (11-16)

The school operated a 10 day timetable. New science laboratories were being built. Two committees of staff were discussing (i) ROSLA (ii) the curriculum.

Science

| Years | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5<br>4 | pupil options (in state of flux) | O-level and CSE together | biology or rural science and/or chemistry and/or physics |
| 3 | class groups, ability streamed | | biology or rural science and chemistry and physics |
| 2<br>1 | class groups streamed mixed ability | | physical science and biology |

Teachers

The department was staffed by two full-time science teachers: the head of science (a physicist) and a teacher of rural science. Two staff taught chemistry and mathematics, one biology and mathematics and one P.E. and biology.

The head of science had moved recently from a public school where he had been involved in trials of Nuffield O-level physics materials and was about to introduce a Nuffield A-level course when he left. He demonstrated a high familiarity with curriculum developments in science.

He reported that there had been no use of Nuffield materials in the school before he came to it. He had introduced the use of Combined Science materials into the physical science work of Year 1 and hoped to extend the approach up the school. He was thinking about a Mode 3 on Secondary Science for the ROSLA pupils.

He saw four restrictions on his use of Nuffield materials -

(i) his own heavy teaching load (70-80 periods in 10 days), making planning difficult,

(ii) the abilities and interests of local children,

(iii) the staffing of the science department,

(iv) restrictions on the availability and use of finance.

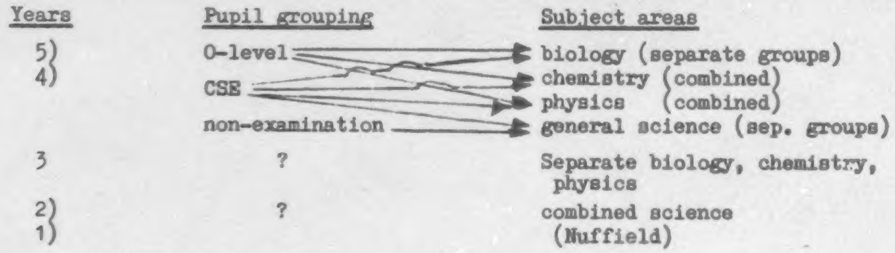
He reported an interest in investigating the acceptability to the universities of candidates following Nuffield courses in schools.

School Bd size: 600-800, mixed comprehensive (1970) (11-18)
(School opened as a General Secondary school ten years ago)

The headmaster very keen to develop continuing contacts with feeder primary schools. The Swedish Mathematics Project has been used enthusiastically in the school.

Science

Specialisms not highly insulated, but specialists assumed responsibility for examination work.



| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5)<br>4) | O-level<br>CSE<br>non-examination | biology (separate groups)<br>chemistry (combined)<br>physics (combined)<br>general science (sep. groups) |
| 3 | ? | Separate biology, chemistry, physics |
| 2)<br>1) | ? | combined science (Nuffield) |

No Mode 3 CSE courses were in operation

Teachers

Biology was taught by the head of science who had been on the staff since the school opened (10 years). He was following the O.U. Foundation Course in Science.

He used Nuffield materials in Years 3 and 4. He was responsive to "climate of opinion". He was looking for a course in Years 1 and 2 to replace the General Science course he had developed in the early years of the school and which "wouldn't do now", when the physicist, fresh from a training course, joined the staff and suggested Nuffield Combined Science. He reported himself to be favourably disposed towards integrated science courses and when he saw dome SCISP materials at a day conference in the county he expressed an interest. The L.E.A. man present got in touch with the local Schools Council Field Officer who visited the school and lent further materials over the week-end. The head of science was disappointed with the materials but was not able easily to identify why. As he appeared somewhat troubled when questioned further, this was not pursued.

He reported that pupils continued to "write up" experiments from the Combined Science work in the traditional way - no one had taken on the job of preparing worksheets. Examining the Combined Science work was difficult if teachers developed different parts of the work in response to their own or pupils' interests.

Chemistry. An older man was responsible for the chemistry courses. He had attended an early in-service course on Nuffield Chemistry (1966), but did not use any of the materials. He was on the CSE General Science Panel and reported that he was "not interested in Nuffield Secondary Science" as it did not have a high chemistry content. He felt no obligation to change his examination work and was critical of some of the Combined Science work in Years 1 and 2.

Physics. A mature man, who had followed a Graduate Dip. Ed. course recently, was responsible for work in the physics section. He was appointed three years ago. He was currently preparing an M.Ed. by dissertation.

He was familiar with all the Nuffield materials for the 11-16 age group, but was somewhat appalled by the need to re-think yet again in terms of SCISP.

The head of science reported him to be "immersed in new ideas", and to be the decisive factor in the introduction of Combined Science into Years 1 and 2 and Secondary Science for non-examination pupils in Years 4 and 5. He used some Nuffield Physics materials in his GCE/CSE course, and saw pupil-ability excluding whole use.

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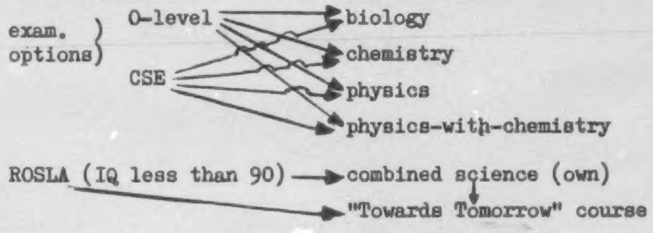
**School Be** size: 1000+, general secondary, becoming comprehensive 1973 (11-18)

The school had been through a difficult phase and a General Inspection had been requested the year before. The area attracted largely middle class, professional people. The school had offered A-level courses for eight years. Parental pressure for academic success was high.

The new headmaster was a warm, relaxed, lively personality. He was very interested in the project and arranged a special lunch for the interviewer in the Home Economics room, together with all the science staff, the woman deputy head (a biologist) and himself.

## Science



| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5 | exam. options) O-level | biology |
| 4 | CSE | chemistry |
| | | physics |
| | | physics-with-chemistry |
| | ROSLA (IQ less than 90) | combined science (own) |
| | | "Towards Tomorrow" course |
| 3)<br>2)<br>1) | banded within department | biology and chemistry and physics |

In Years 4 and 5 the pupils had to choose one science and usually chose two. The headmaster reported that the sciences were popular options.

The department was staffed by 8 full-time and one part-time teachers, and one lab. technician. It had only four laboratories, with promise of more, but building had not started. In Years 1-3 whole year groups were timetabled for science (10 groups), therefore more than 50% of the science took place in ordinary classrooms. This was reportedly organized, using trays of apparatus, so that 75-80% of the work was based on pupil-investigation. Work sheets were extensively used - upwards of 10,000 being in the department at the last count. These were hand-written and copied on the Banda machine - a decision not to type and prepare stencils had been made for fear of discouraging revision. All work sheets were revised at least once a year.

The three sciences were taught separately from Year 1, except for a recently planned course for the ROSLA pupil that was being developed as a Mode 3 CSE course in its own right as well as contributing to a specially designed interdisciplinary course. The content of this course was determined "by asking the children themselves what interested them". In spite of the separate subject divisions, the head of science referred to the first three years work as "our course" in the singular.

The whole department met together for teabreak each day and all seven staff interviewed reported frequent and varied discussions with science colleagues, but few with other members of staff. The department was characterized by enthusiasm, hard work and self-confidence.

## Teachers

Biology. The head of biology was absent with appendicitis on the day the school was visited. The assistant biologist was leaving in a few weeks to have a child. She was essentially a specialist biologist, seeing modern biology as including much physics and chemistry, and had little interest in or knowledge of integrated science materials.

The Nuffield biology texts were used more frequently than work sheets in the early years. It was possible that the full Nuffield O-level course would be offered when the school received the full ability range.

Chemistry. The school tried out the Nuffield O-level chemistry course early on, but decided it "didn't suit, as it wasn't meant for our ability range". The present head of chemistry joined the school later. He had trained in 1967 under John Bradley at Hull and reported a sharpening of interest arising from Bradley's denunciation of the Nuffield Sample Scheme. He had reservations about the ability of integrated courses to prepare for further work in chemistry and reported his great reluctance to teach outside his own discipline.

Physics. The head of science was also head of physics. He had attended a Nuffield Physics course in 1966, and had recognized the claims for pupil-based experimental work. He had used a special "Nuffield" grant to increase the resources of his department each year, but was critical of the financial arrangements that restricted petty cash "only enough to buy animal food" and created difficulties for those who wished to make their own inexpensive apparatus.

The interviewer spent much of the day with the head of science in the prep-room (when not interviewing other teachers), noting his response to other members of his department as they came and went. He was constantly tossing remarks that conveyed acceptance or approval, teasing, but slipping in reminders and generally maintaining a sense of purpose. His sensitivity to others' needs was apparent in his comment "I feel it very important that each member of staff teaches the subject he feels happiest in. I had highly qualified biologists saying 'Look here, I don't want to teach physics - my interest is not in physics but in biology'. I weighed up the pros and cons and decided to go for the separate sciences right from the first year."

It may be significant that all other members of the department are by some years his juniors.

It emerged that while he was secretary of the Curriculum Development Group the meetings decayed - hence the judgement that his high leadership qualities were parochial. The headmaster was planning to use him for pastoral work in the school (his only recent involvement in in-service work had been a course in counselling).

It appeared that the science department had been little affected by whatever problems had beset other areas of the school. Decisions had been made by a head of department who involved his colleagues in frequent discussions, was highly sensitive to their needs and those of the pupils, believed strongly in learning through pupil-based activity, and was determined not to let shortage of accommodation and finance hinder the use of these methods. He asked a great deal from his colleagues, but provided the support in which they were pleased to commit their efforts.

School Bf. size: 1000+, mixed comprehensive 1968 (11-18)

The school was organized into Upper and Lower schools on the same site. Senior staff served on a Board of Studies or a Pastoral Board. There was one staff meeting a year. Staff tended to take classes mainly in one set of buildings only. Mixed ability groupings of pupils were widely used in the school, which was seen by the LEA as operating them successfully and used as a "show piece" for other schools enquiring about their working.

Science (Organization was complex)

| Years | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5<br>4 | mixed ability, pupil choice of at least one of could be offered at GCE, CSE, or non-examination | | biology<br>agricultural biology<br>chemistry<br>physics or physics-with-chemistry<br>engineering science |
| 3 | top 30 (6 periods)<br>3 equal groups (4 periods) | | biology and physical science (2 teachers) |
| | bottom 18 (4 periods) | | general science (1 teacher) |
| 2 | mixed ability | | biology and physical science |
| 1 | 9 mixed ability groups (with some remedial withdrawals) | 5 | integrated science (Scottish) |
| | | 3 | 80% biology + 20% materials science* |
| | | 1 | environmental science+ |

* There were two alternatives for the materials science (a) written by the chemist, (b) extracted from Nuffield Chemistry Stage 1.

+ Written by a bio-geographer

For the following session the Year 3 work was planned as a team-teaching situation with two equal half-year groups of approximately 140 pupils.

## Teachers

Biology. The head of science was also responsible for biology. He claimed to have used approaches similar to those used by the Nuffield biology when he had been teaching in a grammar school.

The style of leadership he practised appeared to be one involving highly detailed organization, but the distancing of himself from the members of his department. He commented that he did not talk to other people very often and communicated within his department through duplicated hand-written notes - arrangements for the interviewer's meetings with staff were made known in this way, with the comment "I offer these arrangements and assume they suit all" (and ending with "Many thanks"). The heads of physics and chemistry were both men of his own age - one perhaps older - with definite opinions of their own. It is possible that the emergent style of leadership within a group is determined, in some measure, by the population of the group.

Important determiners of curriculum decisions appeared to be:

(i) the strongly held opinion of the head of science that nothing can replace a course that a teacher has worked out for himself, from his own experience.[1] (This accounts for the variety of courses offered in Year 1.)

(ii) the assumption that his practice has preceded some of the changes contained in national curriculum projects - "if you like, there's a certain complacency in my attitude towards them".

(iii) the low status of integrated science courses, reportedly as perceived by the pupils and the headmaster, but also embodied in the structure of the Year 3 course.

(iv) the absence of any over-riding status support for Nuffield courses - "there's such an enormous range in science teaching of what is acceptable and good, that something (in a colleague's presentation) would have to be rather extreme for me to interfere".

The two "directions of change" that evoked response in him appeared to be the operation of mixed ability groups and the emphasis on "process" rather than "content" in science courses. He reported that he had just failed to obtain secondment for a full-time M.Ed. course in which he had hoped to examine historically the place of scientific method in science education.

Chemistry. The head of chemistry had wanted to introduce Nuffield A-level chemistry in 1968, when the school became comprehensive, but "it was too late for trials and too early for publication". Having developed an alternative course it did not appear worth changing.

He was possibly a highly successful teacher. The interviewer observed groups working on projects in the labs during the lunch hour. One group of girls, investigating the pollution of drainage ditches into the local river, had written to the local press and a follow-up feature had been requested.

He was highly critical of both Nuffield Combined Science and Secondary Science, calling one a hotch-potch of separate sciences and the other too sophisticated, not reflecting the real interest of children

A chemist with a doctorate but no training, newly appointed and working mainly in the Lower school, expressed a high degree of dissatisfaction with his work and the support he received. He had not heard of "the ASE".

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[1] It is interesting to speculate on the possible origins of this opinion: it could reflect a sense of professionalism and the autonomy of the teacher in curriculum matters; on the other hand, interaction between a reserved person in a position of authority and independent colleagues could be rationalized thus.

**Physics.** The head of physics was a blunt northerner. He was critical of the dispersion of effort within the department: "Staff should get together to prepare work sheets and schools should get together to work on a Mode 3."

**Rural Science.** The head of rural science was discouraged by the decreasing support for rural science that had accompanied recent curriculum development in science. There were few young teachers equipped to teach it and many biologiest "didn't want to know".

All four senior men were involved in other school duties, one being head of Junior School, two were musicians and contributed to youth music and a third was deeply involved in leadership in youth and social work within the local church.

**School Bg** size: 1000+, mixed comprehensive 1968 (11-18)

The school was organized as Upper and Lower schools on two separate sites a mile apart. The deputy head had been head of science and maths at another comprehensive school.

## Science

There were three separate science departments, with no overall head of science. A recent decision, taken at administrative level, was that only English and mathematics were to be compulsory subjects in Years 4 and 5. The three sciences occurred in the options and there was no constraint on any pupil to choose one of them. There were plans to create a head of science post. All but the head of physics took morning break together in one of the prep rooms.

| Year | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5 | O-level, CSE separately (if numbers permitted) | → | biology and/or<br>chemistry and/or<br>physics |
| 4 | pupil choice: mixed ability | | |
| | very weak set (CSE Mode 3) | → | hobbies' science |
| 3)<br>2)<br>1) | 2 broad bands | | biology and<br>chemistry and<br>physics |

## Teachers

**Biology.** The head of biology was not prepared to enter into discussion. He had been longer on the school staff than any other teacher in the science departments. The second in department justified non-use of Nuffield materials in terms of pupils' restricted ability and dislike of investigation and the responsibility of the school to get them qualifications that would be useful to them. There were only 14 pupils studying biology in the current Year 5.

Chemistry. The head of chemistry had worked in industrial research before teaching and claimed that he would find the proper teaching of chemistry very difficult without such experience.

Chemistry was the most successful science in terms of pupil choice: last year 50+ pupils entered O-level, 55% passed and 27 (including 9 girls) had continued to an A-level course.

The department was involved in feasibility trials for common examining at 16+. The approach had been made through the headmaster who had consulted with the head of chemistry before agreeing to participate. The syllabus used for this made some reference to Nuffield materials for various topics. The head of chemistry judged he could report use of about one third of the materials, but commented that he did not use the approach. His chief reservation lay in his reluctance to see a child "waste time" in pursuing a "blind alley" to get a "wrong" answer.

A young teacher commented that the school laid great stress on examination results, being very conscious of its secondary modern origins.

Physics. The head of physics claimed that "things are usually given to me to disseminate to the others".

He was concerned about the pupils' low choice of physics compared to chemistry but "there is more in chemistry to play around with. Physics makes more demands. You can't get far in physics without asking why". This, combined with the threat to science numbers in the new open options, had led him to investigate the possibility of the J.M.B. "Two Science" O-level proposal. (A leaflet advertising it had arrived at the school.) He had discussed it with the deputy head, who had given his support and in the absence of a head of science - "(We need it for decision-taking here) - it means I shall have to go and woo the others."

The attraction of this syllabus and examination was its coverage of all three sciences (seen as educationally desirable), so that they were no longer in competition with each other, and "science" would be in a more powerful bargaining position when "core" subjects were considered. Moreover, the three disciplines were entirely separate in the syllabus so that each part could be taught by a subject specialist.

A young physicist had volunteered to prepare a non-specialist course for less able pupils, based on hobbies. This had run for two years as a non-examined course but as he was "in danger of losing it" in the new course arrangement, he had developed it into a Mode 3 CSE course, using some Nuffield Secondary Science materials and apparatus. The head of physics commented that he was "grateful for Mr. ----'s enthusiasm."

School Bh size: 1000+, mixed comprehensive (1973) (11-18)

The school was organized as upper and lower schools on one site, with an entry of 11 forms.

Science.

| Years | Pupil grouping | Subject area |
|---|---|---|
| 5<br>4 | GCE and CSE (where numbers chosing option permit) pupil choice, mixed ability. | biology* and/or chemistry* and/or physics*<br>general science (CSE only) |
| 3 | 5 'A' forms, taught by specialists | biology, chemistry and physics (2 per week each) |
|  | 5 'B' forms (one teacher for all science) | general science (3 periods per week) |
|  | 1 'remedial' form | ? |
| 2<br>1 | Two broad bands | Nuffield Combined Science (3 periods per week) |

* said to be "traditional courses"

A recent decision had been made to link with the local technical college for ROSLA work (see later).

Teachers

Biology. Not interviewed.

Chemistry. The head of chemistry used some Nuffield materials. He was currently following an O.U. Foundation Course in Science.

Physics. The head of physics was also the head of science.

He assumed the O-level materials were for the brighter child and therefore not relevant to his situation. He approved of Combined Science and Secondary Science.

The decision to use Combined Science in Years 1 and 2

(1) The influence of the early Nuffield materials had led to staff planning a general science course for the lower school based on work sheets and involving much pupil practical work.

(2) Nuffield Combined Science was published; a school in another town was known to be using the materials.

(3) The head of science went to see the work done in that school and read the materials, finding the approach similar to that developed by his own team, but with more ideas in it.

(4) Lower school science staff had also seen materials and were keen to use it.

(5) The decision was made to use Combined Science in Years 1 and 2.

(6) The lower school staff remained enthusiastic and the upper school staff liked the effect on the pupils - "children from the lower school are not afraid to handle apparatus - we are on the right path to produce good scientists".

(7) The course is likely to continue.

### The decision to link with the technical college

(1) The head of science knew of Nuffield Secondary Science materials and had thought of using them "at the bottom of the CSE band".

(2) With ROSLA imminent a post of special responsibility was created to plan the curriculum for the pupils due to stay an extra year in the schools.

(3) The ROSLA teacher made contact with the local technical college and found them more than willing to co-operate in building and engineering sciences, home economics and catering courses.

(4) The head of science had reservations that "the kind of science a tech. might recognise would be rather 'old hat' - mechanics etc. - I don't think this is very relevant to these boys and girls - a pity to narrow the field of science. If I did Secondary Science we could broaden out and tackle all kinds of topics - I would prefer that with this type of child".

(5) The decision was made to develop links with the technical college, the school covering the basic science of the courses, with the head of science remaining "apprehensive" but "game to have a try".

It may be that the possible future advantage to these pupils of making an early link with the technical college was an important factor here. The school showed a high awareness of the need for a flexible system of education to allow for the late developer to gain qualifications.

The interview with the chemist illustrated this concern for the late developer. When asked why the children were "late developers" in the area, he replied "because they are given a chance to develop". He described how every effort was made to keep groups together in the sciences in the fourth and fifth years. At the end of Year 4 "pupils are asked which exam they want to do" but final decisions were not made until after the "mock" exams at Christmas. Then "on bulk more enter for CSE than O-level - it's better to put borderlines in for CSE where they will get a certificate".

Success story: "There's a lad now in the sixth form who got 5 grade 1 CSEs. The next year he converted them to O-levels and got 7 O-levels altogether. He decided to stay on to do A-level in physics, chemistry and biology - that wasn't a tremendous load, so he did O-level geology with a friend in the lower VI year and O-level applied maths. They then asked to do A-level AEB geology in November and both got pass grades!

Now he has 9 O-levels and 1 A-level, plus the prospect of 3 more A-levels - the system must be flexible."

(This account explicitly illustrates, in extreme form, the concern detectable in many of the "general secondary to comprehensive" schools visited in Authority B and is an important factor in decision-making vis-a-vis the use of national curriculum projects that may possibly require (or are perceived as requiring) a separation of "more able" pupils at an early stage to follow the course successfully.)

School Bj size: 400-600, mixed comprehensive (1973) (11-18)
(Little was discovered about the school organization.)

## Science

The work was organized in the separate sciences except for the non-examination work in Years 4 and 5. The school was one of only two in the county not represented on lists of schools sending teachers to Nuffield courses in 1966.

## Teachers

There were four teachers: three responsible each for a specialist science and a probationary biologist.

Biology. The senior biologist appeared easy-going and was fairly familiar with project materials. He reported: "It's my decision what I incorporate into my course. I knew about Nuffield, but didn't use it until exam boards began to - exams are of paramount importance." The probationer was cheerful, but "I don't teach any good forms - I'm just filling in gaps until next year."

Chemistry. The head of science was a chemist. He was obviously discouraged by what he perceived as lack of time, space, money and an isolated position. He lived close to the University city and was a member of the Chemistry Teachers' Centre there, of the CSE Board and the County Science Teachers' Association. In spite of this he questioned "Where does one get information in an isolated school?" and displayed a generally defeatist attitude.

Physics. The full effect of the discouragement in this situation could be seen in the physicist:

"It's 3 years since I did a P.G. course. The department was fully equipped on Nuffield Physics and that's where I learned about it. Other than that my means of keeping up is the catalogues. In this school I'm going backwards, forgetting what I knew 3 years ago and learning about very little else. There's no spare cash whatsoever. I've been here while there have been grants for Nuffield science, but they've never been big enough. We spin it out - get ½ set, etc. We're so desperate for other types of apparatus that this would not be provided if we bought Nuffield. There are other restrictions, too. This school doesn't give enough time for physics teaching. We have to make sure that O-level course is begun in year 1 as I don't like leaving chunks out of the syllabus. I like to cover the lot. This means that amount of work I have to cover is quite large, so I have to look at practical and decide what I'm going to do and what I'm not. I don't subscribe to the view that practical work is necessarily the better way of working on principle. I've seen children working, where they've enjoyed it, but haven't really been sure what they have been doing and probably never will, whereas a well-run class demonstration would have got the point across and made them appreciate the full extent of the results, so I'm not too upset that a lot of the practical work we do has to be of the demonstration type. But if I can see the gain beforehand there'll be a class practical.

But back to Nuffield - it all ties in: we're limited for time, we're limited for money - I don't feel I can waste time or money so practicals are only done where I can see a definite end-point in view, there's no experimental technique whereby they're given something to play with and see what comes out - it's odds on that they'll find the wrong thing because of their inability to interpret things properly or they'll simply not have got any results at all and have wasted time. I much prefer to guide them so that they'll come up with results that are reasonably correct.

Nuffield is limited by time and very very limited by money - that's not to say that if equipment had been here and storage space, I wouldn't have liked to do it - I probably would.

I don't really see the need for the projects - they haven't really come up with anything new - just American ideas and teaching techniques that have had a lot of trouble crossing the Atlantic - better communications could have made it more effective. The DES should put out a monthly bulletin, one in physics and one in chemistry, with details of new techniques and recommend to LEAs whether or not their schools should get equipment. Almost need directives as to money to be spent - no good giving ideas and incentives if there's no means. I got incentives from Graduate Certificate and just haven't got equipment, time or storage."

School Bk size 1000+, mixed comprehensive (1955) (11-18)

A 7/8 form entry school, divided organizationally into upper and lower schools in the same buildings.

Science

| Years | Pupil grouping | | Subject area |
|---|---|---|---|
| 5<br>4 | pupil choice (from bands 1 and 2 only) | GCE or CSE → | biology and/or chemistry and/or physics |
| 3 | band 3 | CSE → | general science |
| | bands 1 and 2 | → | biology and chemistry and physics (3 x 2 p/w) |
| | band 3 | → | general science (6 p/w)<br>horticultural science (3 p/w) |
| 2<br>1 | band 1 (2 gps.)<br>band 2 (3/4 gps.)<br>band 3 (2 gps.) | → | general science (5 p/w)<br>horticultural science* (2 p/w) |

* Band 1 in Year 2 do no horticultural science.

The science was organized in three separate departments (with rural science quite separate from them). The money was "split three ways" which made the equipping of integrated courses problematical.

An unusual feature of the school was that every member of the science staff (11) was a first appointment, so that knowledge of other schools was minimal. The head of physics had taught there 13 years, chemistry 8 years, and biology 20 years - "we are the envy of other departments in the school for our continuity".

(Unfortunately, because of a fault developing in the recording only part of one interview - with the head of science - remains on tape, but this provides interesting insights into decision-making in a stable situation.)

"Yes, there was a need for the projects - any project. We're looking for different approaches all the time. We are a very traditional school here - I'm both proud of it and apologise for it. We are traditional, and second-to-none in teaching exam. work, but try to introduce new ideas, but we don't get to know about too many. I'm just starting a scheme whereby the second in each department gets off to as many courses as possible, in the hope that they will come back with new ideas that we can use. But I'm against having to use them. We will use what we want."

And later, when asked about SCISP. "I've read a little and more recently - to prepare members of the department for interviews - we've discussed what they ought to know". Shows an interesting professional concern for junior members of the department.

This man appeared to have a cautious, but open approach: "For the last two or three years I have made a point of teaching the bottom two forms in the first and second years and have found, to my surprise, I can teach almost the same course - using micro-balance kits, by modifying techniques and given time. I am amazed at their dexterity ——— They work on their own, but you can stop for discussion where necessary. In working this way I have been surprised by the use of materials I judged at first to be suitable only for grammar schools——— It alters the whole style of the lesson - you can still tell the difference between the traditional and new parts of the syllabus in Years 1 and 2. We are critical now of these more traditional parts and ought to be on the look-out for new approaches to these."

C. L.E.A. (C) County borough authority, size category SMALL.

Special characteristics

It had operated a mixed system of secondary schools: two highly selective grammar schools, one for boys and one for girls, (a locally-esteemed, direct grant school accepted a considerable number of able girls also) several bilateral (grammar and modern) single sex schools on the perimeter of the city, and a few older, secondary modern schools within the city. The post-war plan had been to replace all the older schools progressively by bilaterals, each carrying a trade bias, with open choice to all pupils, but economic constraints had blocked developments in several years. Two mixed comprehensive schools have been established since 1970. There was a plan to convert all schools to a comprehensive basis in 1973.

There was a university sited in the city. Separate teachers' centres in all three sciences were associated with this.

There were no special subject advisers (except for Home Economics, Music and Physical Education[1]) but a Teachers' Centre had been established in 1970. This had soon been renamed a Curriculum Development Centre when a warden, with a high-status salary, was appointed.

No school within the LEA had been used for trials of any Nuffield science materials, but five other projects had been supported, some of these were mathematics projects associated with the local university. None of them had succeeded in becoming established in the schools.

There had been a recent move away from a policy of internal promotion that had operated within the LEA for many years. Several schools had had problems in attracting and keeping teachers in the sciences and mathematics. (This was reported both by schools and by the LEA)

A recent HMI inspection of science had been carried out in the borough schools. Several schools mentioned that this had been critical of science courses. The use of Nuffield Combined Science materials had been recommended and its introduction into several schools had been closely associated with the activities of the local science HMI. Considerable grants were made available by the LEA to these schools. Two schools were also planning to become Phase 3 trial schools for SCISP with the backing of the LEA.

The first in-service course for secondary school science teachers to be run by the LEA was held at Easter 1973 in the local comprehensive school. It was organized by the warden of the Curriculum Development Centre and staffed by teachers from the LEA and a neighbouring one.

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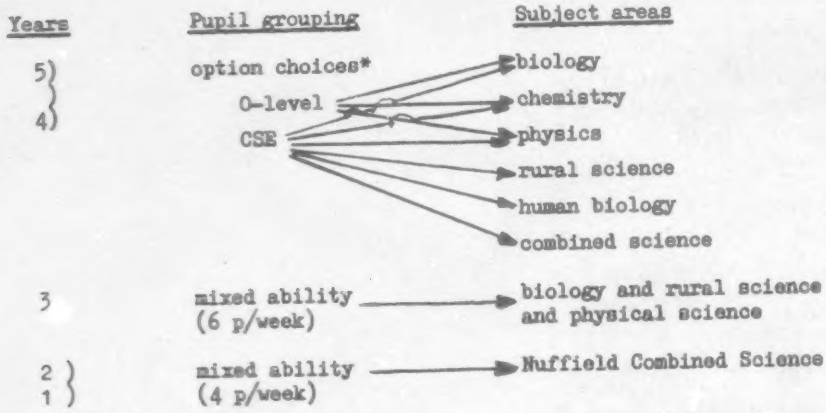
[1] Education Committees Year Book 1971-72.

**School Ca** size: 1000+, mixed comprehensive 1970 (11-18)

This was established as a new school in 1970, absorbing a small secondary modern school. It was attempting to develop courses around a resource centre, in ways similar to schools Aa and Ab.

**Science**



| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5<br>4 | option choices*<br>O-level<br>CSE | biology<br>chemistry<br>physics<br>rural science<br>human biology<br>combined science |
| 3 | mixed ability<br>(6 p/week) | biology and rural science and physical science |
| 2<br>1 | mixed ability<br>(4 p/week) | Nuffield Combined Science |

* "Pupils must choose one science, may choose two, but may not choose three".

The head of science was appointed 12 months before the school opened. He equipped the labs so that any of the Nuffield O or A courses could be used. At the time of interview only the Combined Science course was used.

**Decision to use Combined Science**

1. Time table restriction of four periods per week prevented equal division of biology, chemistry and physics, therefore they were looking for an integrated course.
2. The then head of chemistry knew of it and liked it.
3. The objectives fitted into those of the school.

Some modifications have been made - "I have known some young teachers who have hidden behind the apparatus", so that more class discussion and consolidation has been built in. The department has stopped examining the course in Years 1 and 2 as assessment proved difficult.

Year 3 had been an integrated course, but it had later been divided as above as staff preferred not to teach "right across the board". The time allowance would provide for 2 periods per week in biology, chemistry and physics but "we don't want to lose the rural science".

The school had been asked by the LEA to be a Phase 3 trial school for SCISP, but this had been refused as:

1. a double O would cater only for 15% of pupils,
2. separate Os in biology, chemistry and physics would still be necessary for vocational purposes and possibly for sixth form work,

3. staff were not equipped to teach it - "a real problem",
4. they did not need the money.

This decision was made by the head of science after consultation with other members of the department, but chiefly with the head of physics.

### Teachers

Biology. The head of biology was also the head of science. The reason he gave for not using the full Nuffield O-level course was that the local CSE Mode 1 was more like the "traditional" O-level of the GCE board than the Nuffield O-level and this enabled the separation of pupils into CSE and O-level groups to be delayed until the examination entries were due.

He had been associated with the revision of the Nuffield course and had further reservations about it, feeling it was intellectually too difficult for a general O-level course and that it was not easy to establish real understanding using the methods recommended - "content is important - you become dilettante if you ignore it".

Chemistry. Both the older chemists were Australians on temporary appointments. The head of chemistry, about to take up the post, had used both O and A Nuffield courses, so that a junior member of the department hoped more Nuffield work would be introduced. Her perception of the masking effect of too much practical work on understanding was similar to that shown by the head of science, but she was impressed by the confidence shown in laboratory work by pupils who had followed the Combined Science course.

Physics. The head of physics was planning to use the Nuffield A-level course, but excluded use of the O-level course as:

1. "they can't choose to do physics until the end of year 3",
2. "Nuffield is a 5-year or a 3-year course",
3. "Nuffield is more difficult, and you'd need to stream from Year 1".

He regretted the necessity for chemists to be teaching some of the physical science groups in Year 3 and was too conscious of the vocational role of physics at O-level to contemplate the use of integrated courses. He was not happy with the mathematical bias to the O-level physics syllabus he was currently using and would possibly "shop around" for an alternative examinations board.

### School Cb

size: 600-800, girls, bilateral comprehensive
(1973) (11-18)

The school had one class of "selected" girls each year, and only about 20 girls stayed at school each year into the sixth form. The new headmistress was encouraging more girls to study science.

### Science

The head of science had recently resigned after illness lasting over two years. It was reported that she had been committed to general science but that "the work was limited and very traditional".

| Years | Pupil grouping | Subject areas |
|---|---|---|
| 6 | pupil choice | biology A<br>chemistry } O-level only<br>human biology } O-level only |
| 5<br>4 | O-level | biology<br>chemistry-with-physics |
| | CSE | combined science (Mode 1) |
| 3<br>2<br>1 | ability banded;<br>(band B gets 1 p/week less time) | general science |

Teachers

The department had suffered severe staffing problems. At the time of interview there were two full-time teachers, one a chemist in his second year of teaching, and one with maths and general science qualifications, who had taught for two years in Scotland, together with three part-time biology teachers. The new head of science was to be a physicist.

The ex-head of science had been committed to general science courses, but "the work was limited and very traditional".

The part-time teacher acting as head of science had joined the staff in 1961 to teach the A-level biology. She had earlier been involved in research in the dairy industry, but had more recently raised a family. On entering the school situation she was professionally conscious of lack of training and set about attending courses. She reported being impressed by the Nuffield Science materials and incorporated them extensively into the courses she ran. She caused the materials to be purchased for the department as they were published. These were kept in the large prep. room that doubled for the head of science's office and she had observed the slight, but increasing, use made of them by the younger teachers.

She reported that the girls found the Nuffield approach difficult but blamed the "traditional" attitude to learning that existed for most work done in the school - "listen, take notes, learn them and reproduce them".

School Cc Size: 600-800, girls, bilateral comprehensive 1973 (11-18)

This school had been receiving two "selective" streams.

Science

The head of science had become ill and after a period of some months had died. The deputy head of science (who had lectured in a Scottish University, taught in a Scottish school during its involvement with Nuffield Biology trials and who had used the Scottish Integrated Science Scheme) had become acting head, and had recently been appointed to the post.

| Years | Pupil grouping | Subject areas | |
|---|---|---|---|
| 5<br>4 | O-level | biology<br>chemistry<br>physics | for future A-level candidates |
| | | environmental science | |
| | CSE | general science | |
| 3 | groupings and courses in state of flux* | | |
| 2<br>1 | mixed ability | Nuffield Combined Science | |

* The school was planning to become a Phase 3 trial school for SCISP, and Year 3 was being reorganized for this. The head of science thought it was possible that a SCISP course would replace all the existing O-level courses and that a Mode 3 SCISP would also be offered for CSE.

## Teachers

Only the head of science was interviewed. She was married, with two small children in the early years of primary schooling. She assumed that it was professionally necessary to participate in in-service training and a family arrangement had been made for her husband to take some of his annual leave to coincide with an appropriate course for her each year.

The following factors were identified as contributing to the decision to use Nuffield Combined Science and SCISP:

1. Scottish teacher, favourably disposed to "new directions" in science teaching became deputy head of department;
2. she found "the curriculum was very prosaic", and "the department was very much underequipped, even for a normal course";
3. she became acting head of department;
4. the school received a critical report from HMIs' investigation and Nuffield Combined Science was suggested;
5. the acting head of science went to a course at the local School of Education and decided to use Combined Science in Years 1 and 2.
6. the headmistress was supportive and the LEA provided £1000+;
7. the LEA passed on the Schools Council's request for Phase 3 trial schools for SCISP to the headmistress, with an offer of financial support;
8. the head of science (now appointed to the post), when consulted, "thought it would be ideal to follow on from Combined Science", and was "going on a course".

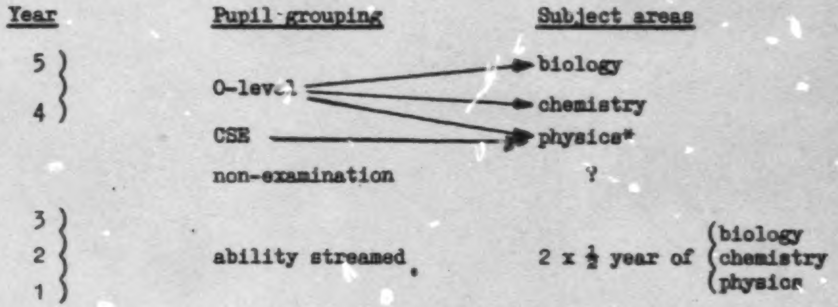
Other comments made by the head of science were interesting here: "I was baffled by the English system and felt it was a great responsibility to have to choose (which course to use in the school) as this would affect the children's future ...... Mr.—— (the HMI) did encourage me." And "I am rather surprised here at the narrow limits within which people teach. In Scotland the physical science people weren't keen on teaching the biology, but they were doing it alright and I felt people were more prepared to have a go, but here I find people are flatly refusing to teach anything that isn't within their narrow limits...... I feel specialist divisions very limiting - the Environmental Science course includes geology and astronomy, that I've never done, but I've been looking at it and thinking - that'll be interesting - I'd like to do it, but some of the department would flatly refuse. It's almost an advantage if you don't know the subject - it means you read it up, become interested and manage to communicate this".

School Cd size: 600-800, boys, bilateral → comprehensive (1973) (11-18)

The school had taken two out of five classes as "grammar school" entries. There had been rigid separation of "grammar" and "modern" streams. A new headmaster (a biologist from industry) had introduced a more comprehensive system of grouping, with emphasis on pastoral care.

Science

The last two heads of science had died in office, one after a long illness. The existing head of science had been promoted internally.



* The physics department was involved in feasibility trials for Common Examinations at 16+

Teachers

Biology. (no teacher was interviewed)

Chemistry. The last head of chemistry had introduced Stage 1 of the Nuffield Chemistry Sample Scheme with the two "grammar" streams only, but, apparently, without consultation. The teacher handling this had been given the texts, but had classes of 35 and reluctant technicians, so that although she was still favourably disposed towards the course it had been discontinued, but "ideas have been included into other courses." The existing head of chemistry was "not keen on Nuffield work", but it was not possible to interview him.

Physics. The head of science was also head of physics.

He was taking part in feasibility trials for Common Examining at 16+ in physics and had been elected chairman of the working party.

He favoured the teaching of separate sciences to streamed ability. He would like to see two periods per week in Years 1-3 in each of the sciences, taught by specialist teachers. (This was partly a response to the situation arising from a rapid turnover of junior teachers in the department.) He had introduced the current arrangement of 2 x ½ year in each science, but was under pressure from the headmaster, and advised by

HMI, to use an integrated course. They had decided not to use the Nuffield Combined Science course, (it was possibly too different from their own practice) but to design their own course, drawing upon the Nuffield materials. This was in spite of their understanding that as they were not using the full Combined Science course they would not receive extra financial help from the LEA.

It is possible that the resistance to "Nuffield type working" detected here found support within the working party for Common Examining in physics, for "the headings (of the suggested course) are Nuffield-like, but the approach and depth are different". There had been no conscious use of Nuffield Physics materials, "the syllabus was built up initially from each member of the working party sitting down and writing down what he thought ought to be contained in a physics syllabus". A common core resulted, with an option paper, to allow for variety.

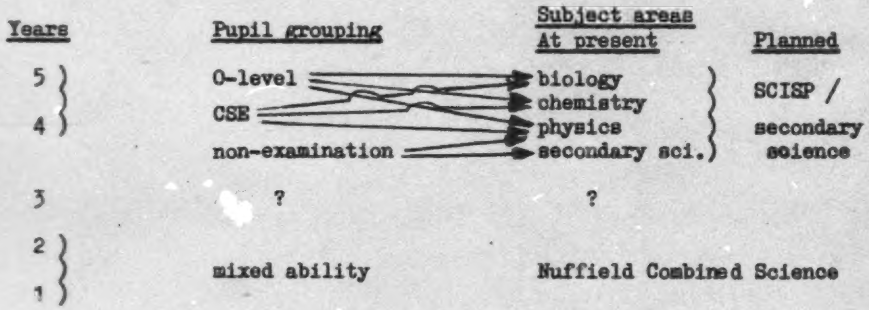
School Ce size: 800-1000, boys, bilateral → comprehensive (11-18)

The headmaster was reported as "young go-ahead" (not interviewed). The school had a senior appointment carrying responsibility for curriculum development.

The headmaster had included a half hour period (extending to one hour) on the time table for the science department staff to be free from teaching duties. The head of science used this for discussion, pooling of expertises, etc.

## Science

Separate departments were not highly visible, except for examination work. Accommodation was limited but building was in progress.



| Years | Pupil grouping | Subject areas | |
|---|---|---|---|
| | | At present | Planned |
| 5<br>4 | O-level<br>CSE<br>non-examination | biology<br>chemistry<br>physics<br>secondary sci. | SCISP /<br>secondary science |
| 3 | ? | ? | |
| 2<br>1 | mixed ability | Nuffield Combined Science | |

Combined Science was introduced following an HMI report critical of the science offered in the school - a £1000 grant was used to purchase apparatus. Secondary Science books were obtained, together with some pieces of apparatus. Staff were asked to use the new courses, but no training or other preparation was given by LEA.

Technician - ex army - had taken pride in his work and ability to anticipate a teacher's needs - was resentful of the uncertainty introduced by the new courses.

The school had had problems with the staffing of the science department.

Teachers

The head of science was a chemist studying for B.Ed. (part time) at the local College of Education. He was highly familiar with published curriculum development materials and ready to use them. From comments made by several of the teachers, it appears the hasty introduction of Combined Science and Secondary Science had caused problems in the department, but the newly appointed head of science was making an effort to overcome these by discussing problems and organizing training sessions in the hour provided by the headmaster.

He reported dissatisfaction with present practice for the following reasons:

(i) small allocation of time for each science in Years 4 and 5;

(ii) O-level and CSE classes not filled, therefore resources and efforts dissipated;

(iii) few pupils chose to study all 3 sciences, therefore unbalanced diet;

(iv) junior staff needed more support than they received at present.

Reasons for planning use of SCISP

(i) Social orientation and relevance for pupils was attractive;

(ii) it would provide a common course to co-ordinate staff efforts, extending support and sharing expertise;

(iii) it was recommended by HMI and Warden of Curriculum Development Centre;

(iv) (interviewer's suggestion) to provide an arena for leadership.

Other staff

Physical scientist - down-to-earth - concern for slow learners, but familiar with new materials.

Biologist - late entrant to teaching - anxious, meticulous: had been on courses to find out about new materials - not convinced that their use led to real understanding with their calibre of pupil.

Chemist - young - enthusiastic for new ideas - some discipline problems.

Biologist - concern for objectives, prefers middle school work, discipline problems.

School Cf. size: 400-600, girls, grammar (11-18)
(It was possibly to become girls' comprehensive on another site in the future, but plans had not been finalized.)

The school organization was such that all girls followed a common course to the end of Year 4 and then chose examination options. The science teachers claimed this left no time to do anything but a crash examination course in Year 5, and therefore a Nuffield course was out of the question.

Science

| Years | Pupil grouping | Subject area |
|---|---|---|
| 5 | option - O-level | biology or<br>chemistry or<br>physics |
| 4)<br>3) | class groups | biology and chemistry and physics |
| 2)<br>1) | class groups | Nuffield O-level biology and physical science (from Nuffield Combined Science) |

After the science inspection, the HMIs had recommended the use of Nuffield materials. The head of science had decided to use Combined Science but the head of biology disagreed. It was reported that hostility existed between these two. After a period of deadlock the headmistress intervened (with some assistance from the other biologist) and as a compromise the head of biology agreed to use the Nuffield biology materials in Years 1 and 2, for a trial period of two years in spite of her general disapproval of the course.

Teachers

Biology. Botany and zoology were taught as separate subjects in the sixth form - one teacher in the department being a botanist and the other a zoologist. Both had close links with University centres, claiming that academics were critical of the "Nuffield" candidates coming to them from the schools. Both had outstanding examination successes with girls at the school and saw little reason to change their methods of teaching, though they were anxious to see that content kept pace with university requirements.

Chemistry. The last head of chemistry had introduced the Nuffield A-level scheme and the two young women teaching chemistry (both new to the school) were enthusiastic about its use.

Physics. The head of science was the senior physics teacher - the only man in the department. He was a reserved man and was not able to spare time for a longer interview. He said that he assumed that if and when the school became comprehensive he would use Combined Science in Years 1 and 2 and that biology would replace botany and zoology in the sixth form.

School Cg. size: 400-600, boys, grammar (11-18)

The school was an ancient foundation and supported a boarding house, mainly for boys of service families, overseas oil employees, etc. The Corps was an important element within the school and was run jointly by the head of science and the head of physics.

Until recently it had operated a six-year course to A-level so that O-levels were by-passed by the serious scientists.

## Science

Year 1 - Nature study "I don't know what —— does with them over there" (indicating hut).

Year 2 - "We house-train them" (instructions in chemistry syllabus insist that not more than one half the time should be spent in pupil practical work).

Year 3 }
4 } Most boys do chemistry and physics; a few do biology.
5 }

"The purpose of the school is to do the best for ——— boys and examination results in science show that we do this."

## Teachers

**Biology.** This has a low status in the school. The head of biology was following the O.U. post-experience course in Animal Behaviour. He had a few investigational projects set up and had attempted to use Nuffield materials with the O-level group, but both pupils and teachers had taken fright at the insecurity experienced and had abandoned their use. The assistant biologist was ex RAF recently from a teachers' certificate course and following the O.U. Foundation Course in Science.

**Chemistry.** The head of science was a teacher of long standing who had every confidence in his own methods. He was an influential member of the AMA, representing it on Schools Council committees. He was good-temperedly patronizing of "new directions" in science teaching.

**Physics.** The head of physics was familiar with the new American and Nuffield science materials.

He claimed "I agreed with much that the HMIs said about Combined Science and said 'O.K. let's have a try'. We were offered £200 when we needed £2,000, so it wasn't on."

D. L.E.A. (D) County borough authority, size category SMALL.

Special characteristics

A system of grammar and secondary modern schools was being replaced after much discussion and uncertainty by tiered middle and upper schools in 1973. Two of the erstwhile grammar schools visited had earlier been formed by the amalgamation of two smaller schools in a move from the city centre.

There was both a University and a Polytechnic sited in the city. There had been separate teachers' centres in Physics (at the University) and in Chemistry (at the Polytechnic), but, when suggestions for a Biology centre were under discussion, the structure was changed, with the establishing of a Centre for School Science and Technology, based in the University, but receiving support from two LEAs, the School of Education and local industry. This developed largely from the activities of one man, who had worked both in schools and in industry and who had recently spent time, on an industrial grant, examining the whole question of activities at the interfaces of schools with higher education and industry.

No specialist subject advisers existed (except in Girls' subjects, Handicrafts, Music and Physical Education[1]) but one AEO, of relatively recent appointment, was a scientist and had moved from an LEA in which a schools' science centre had been established.

Some secondary modern schools had been used for trials of Nuffield Secondary Science materials. Several heads of science in the secondary modern schools had formed a group which had operated through the sixties (and possibly earlier), to discuss common interests (namely physics) and common problems.

One influential teacher of chemistry in 1966 persuaded the LEA to support a course in Nuffield chemistry. This had not happened in physics and biology.

The LEA supplied financial support for any school wishing to adopt the materials of a science project. They had recently asked upper schools if they would like to serve as trial schools for Phase 3 of SCISP, offering a grant.

The staffing in the science departments in the schools had appeared to be relatively stable.

A working party on Middle School Science had been established by the AEO. After four meetings it had fallen into abeyance and three teachers, who had been members of it, were not happy about its role.

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1. Education Committees Year Book 1971-72.

School Da     size: 400-600,   girls' grammar → girls' upper school (13-18)

This was a well-cared for girls' school. Its future had been uncertain for some years. An initial reorganization proposal of linked schools had been abandoned. A subsequent plan for it to become a mixed upper school had been disallowed by the Secretary of State, following a petition submitted by local people, including many parents. Entry in future would therefore be dependent on parental choice of a girl's school and there would be no specially linked feeder middle schools.

### Science

This was complex and changing. The school had received 80 "secondary modern" girls into Year 3. The department hoped to go over to mixed ability groups in Year 3 in two years time when the entry was comprehensive. Meanwhile they were conscious of a "grammar stream" in the school and the need to do the best for those girls and their parents.

### Arrangement (September 1973)

| Years | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5<br>4 | O-level course, choice of not more than 2* | → | biology, or<br>chemistry, or<br>physics |
| 3 | "grammar" stream<br>"middle" stream+ | →<br>→ | biology and chemistry and physics |
| | 2 slow groups | → | physical science and biology |
| 2 | "grammar" streams | → | biology and chemistry and physics |

* Those girls who might wish to study science in the sixth form (and this was a considerable number: in 1972, of 23 university places gained, 11 were in science subjects) had been directed into chemistry and physics options and had bypassed biology "keeping it going with two lessons a week".

+ The "middle" stream contained the "brighter secondary moderns and those of ours we felt would be better going more slowly".

The last head of science, who had retired in 1972 after eleven years in the school, had been described by the headmistress in the school magazine as having "successfully managed the change to Nuffield science".

### Teachers

Biology. The last head of biology had introduced Nuffield biology in 1967 when she came to the school. The first A-level candidates were being entered in 1974.

The present head of biology was new to the school. She was fluent in discussion of curriculum development in science. She reported that schools in England had less influence over GCE examinations than those in Ireland where she had previously taught.

There seemed to be an underlying assumption that biology was different from the physical sciences and easier. The biologist, though in no spirit of complaint, was conscious that the current constraints put biology at a disadvantage - (it was usually the less able girls attempting the O-level course, while the more able worked up an A-level course from a limited background in biology). She claimed to have discovered at a recent meeting that other schools used the Nuffield A-level course only with their better candidates.

Chemistry. The Nuffield chemistry course had been introduced into the school in 1966 by the then head of science.

The present head of chemistry had a Graduate RIC qualification. She hoped to see the wider introduction of technology into schools but her judgement of curriculum materials was made against a concern to establish the content and principles of chemistry. She reported that there was a "closed shop" of men science teachers in the area.

Physics. The head of physics was also the head of science. She had joined the school in 1966 as a probationer having done her teaching practice there. She reported having undertaken the head of science post almost in spite of herself, for she had been planning a move to work with handicapped children. She was interested in integrated science courses.

The first three years of the Nuffield Physics course had been used, at first following the materials closely, but the staff had not been satisfied with the girls' response and had rewritten the materials before they had been used again. A decision had been made to carry on with the GCE examination that had been in use in the school "as it seemed to suit the sort of girls and the ability that we'd got better than the Nuffield......it has just enough recall to give them confidence in their ability to handle it".

An impression of genuine openness to a new situation was apparent in the science department.

Factors that were judged as potential influences were:

(i) the responses of the girls to courses offered to them - all staff were highly sensitive to the quality of pupil satisfaction;

(ii) dissatisfaction with the state of affairs that required all able girls to omit at least one of the three branches of science in the O-level course;

(iii) the head of science's interest in integrated courses and her readiness to teach outside her own discipline;

(iv) the chemist's concern for chemistry;

(v) parental pressure and possibly pressure within the school to maintain academic standards.

From the perceived leadership style of the head of science, any decisions made would be likely to be the result of consensus.

School Db size: 600-800, mixed, secondary modern → upper school (13-18)

This was the neighbourhood school of a large industrial estate. Staff and pupils displayed a pleasing respect for each other and for visitors.

The headmaster had a science qualification and had been chairman of the CSE Board's Science Panel for some years.

Science organization (in the past)

| Years | Pupil grouping | Subject areas |
|---|---|---|
| 5<br>4 | option choice - | |
| | if only one science → | general science |
| | or 2 out of 3 of → | biology/chemistry/physics |
| 3 | mixed ability | general science |
| 2<br>1 | mixed ability | Nuffield Combined Science |

The last head of science, who had recently retired, had participated in the trials of Nuffield Secondary Science materials, but had discontinued their use, saying that it was a lot more work for the teacher and the pupils did not learn any more than by conventional teaching. The headmaster respected his decision - "you can't force people to do things against their will" - and described him as a good, old-fashioned, general science teacher, accounting for his continued use of Combined Science by assuming that it was more readily adapted to his traditional way of teaching.

The new head of science (who had used the Nuffield O-level Physics course in an independent school) had re-introduced the use of Secondary Science into Year 3 (now to become the first year of entry) "they obviously enjoyed the Combined Science and it seemed a pity to go formal again too soon".

He was planning to base sixth form work on CSE Mode 3 courses in biology, chemistry and physics, developed from Secondary Science materials. He was also interested in SCISP and planned to go on a course.

The headmaster was obviously impressed with the tact with which he had handled the teachers in his department and the enthusiasm he had aroused in the pupils in a short space of time.

Factors possibly hindering development were shortage of personnel, both teaching and technical staff, and limited space.

School Dc size: 200-400, secondary modern → middle school (9-13)

The headmaster was resigned to the need to change the status of the school, but did not welcome it.

Science organization (in the past)

| Years | Pupil grouping | | Subject areas |
|---|---|---|---|
| 5 | girls | → | biology ( a little physics) |
| 4 | boys | → | Nuffield physics (O-level) |
| 3 | ? (no longer in the school) | | ? |
| 2<br>1 | mixed ability | → | Nuffield Combined Science |

The head of science - a physicist and post-war Emergency Training College man - was essentially interested in his subject and had a flair for designing and modifying apparatus. He reported that he had "a bit of a reputation as a mad scientist with the pupils and parents". Not far from retirement he had reluctantly chosen head of department in a middle school rather than a subordinate position (as a non-graduate) in an upper school, but doing the kind of work he had spent years developing.

He had no car of his own, which made it difficult for him to attend evening meetings. He did not belong to the A.S.E., but had been an active member of the local physics group when it had been in existence.

When he arrived in the school seven years before, he found grants were available for Nuffield courses so set about using the O-level physics. He claimed to use all the apparatus, but not the full investigational approach.

There were only two labs. in the school - one for physics and one for biology. Very little chemistry was taught and boys and girls were in separate science classes from Year 4, as their abilities and interests appeared to be so different. The girls entered for public examinations only in biology and the boys only in physics.

A general science course had been used in Years 1 and 2 but a young woman biologist, who had stayed five years in the school, had recently introduced the Nuffield Combined Science course before leaving to have a baby. Her replacement was staying for only one term and further appointments were uncertain at the time.

The head of science was hoping to use the Nuffield Physics apparatus with the most able youngsters and had started a science club (boys and girls on separate evenings) to "find what they can do". He had not heard of Science 5/13 and the LEA had planned no courses for middle school science. There were no national vacation courses in 1973 and the one term course offered in Exeter was "out of the question".

**School Dd** size: 800-1000, mixed technical (1) and
girls' grammar (2) merger (1972) → mixed upper
1973, (13-18)

School (1) was founded as a technical school on the site after the war. The emphasis had changed, after HMI disapproval, to a more grammar-school type of curriculum (but without Latin). School (2) had moved to an adjacent site seven years ago. It had been entirely separate until 1972 when the headmaster of school (1) retired. The headmistress of school (2) became the head of the joint schools, two separate school offices were maintained, and the head of science from School (1) assumed this position in the joint schools. It had not been a happy merger.

## Science

This proved complex and no comprehensive analysis has been possible.

Biology. This was taught mainly in the labs. in school (2). The head of biology occupied this post in school (2).

She had introduced the Nuffield materials into school (2) several years before, but had not used them beyond Year 3 as the girls had expressed a dislike of some of the work. The second in department, who had used the full course in another school, was more favourably disposed to the course. She commented that it took time to train girls to operate on process rather than content and with the intake changing at 13+ there probably would not be time.

Decisions are likely to be made within the biology department in terms of the perceived response of the pupils and the influence on examination successes.

Chemistry. (Labs. in both schools were used)

School (1) head of chemistry had used the complete Nuffield Chemistry course for some years. He was now second in the department. He was not interviewed.

School (2) head of chemistry had been to the local course on Nuffield Chemistry in 1966, had introduced the use of some of the materials, but not the whole course. She had been made head of department. She had somewhat hesitantly agreed to use the Nuffield course for the joint schools and still had reservations about the Year 4 work she had been teaching.

A probationary chemistry teacher would have liked to develop a course using Nuffield Secondary Science materials. He saw a conflict between the need to stay in a school to develop work there and the need to move on to gain experience to further his career.

Physics. This was taught mainly in the labs. in School (1). The head of physics was also the head of science.

He was involved with feasibility trials for Common Examination at 16+.

The school received 120 Year 3 pupils from secondary modern schools in 1973. The use of SCISP and Secondary Science was considered briefly for Year 3, but it was decided to leave the courses for the able unchanged and to use from them "the bits that seemed most interesting to lower ability children". The following appeared to contribute to this decision:

(i) a concern to reduce the number of unknowns - (the unknown lower ability children could not be avoided, but the school chose not to investigate unfamiliar materials);

(ii) a concern to integrate the new entries with those already in the school and "to attempt to give them the same kind of start as the other children".

The probationary physics teacher (who had spent some time on teaching practice in a leading school in science curriculum development in Scotland reported being discouraged by the failure he had experienced, in his present school, in his attempts to introduce the investigational approach in his own teaching.

An able and articulate laboratory technician organized the labs. from school (1). (She had been with the school ten years.) She provided tea and coffee for science staff teaching in School (1) labs, and those from art, craft and technical subjects in the large prep. room. This was apparently against the wishes of the headmistress and maintained a separation within the science department as the biologists, teaching in School (2), took breaks in the staffroom there.

School De size: 600-800, boys' grammar ⟶ boys' upper (13-18)

This had been a four form entry (800+) boys' grammar school. Seven years ago two boys' grammar schools merged - one on the present site, and the other from the city centre, to form the present school. New labs were built at the time. It is now becoming a boys' upper school with an entry of 210 boys at 13+. 90 pupils had transferred into Year 3 from secondary modern schools.

The structure of science in the school had been parallel courses in biology, chemistry and physics to O-level (and CSE only in the last year).

Teachers

Biology. The head of biology confessed to being "traditional and not thinking Nuffield", though he did use some of the materials.

Chemistry. Nuffield O and A level chemistry courses were in use in the school. The O materials had been introduced by the enthusiast[1] who had organized the local course in 1966, in spite of hostility from the head of science.

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[1] This man was no longer in the school.

The head of science was also the head of chemistry. He had a doctorate (post-graduate research in chemistry), was teaching at a public school during the trials of Nuffield O-level chemistry there, had taken part in dissemination courses run by Local Authorities etc. in 1966, 67, and had worked with a publishing firm for a short time before becoming head of science at the school in 1968.

When the need arose to make decisions about the science course in the light of the changed status of the school he involved all the science teachers in this, recording discussion and delegating responsibility for carrying out decisions made at the meetings.

Physics. The head of physics had purchased the Nuffield apparatus and used this for the O-level course, though still entered candidates for the local GCE board examination. He planned to introduce the Nuffield A-level course the following year.

The realization that the school was to receive 90 secondary modern 13+ pupils in September 1973 coincided with the approach by the LEA to the school to become a Phase 3 trial school for SCISP, with the offer of a grant.

The head of science made interesting comment on his own awareness of SCISP: he first heard of it when SCISP put out tenders for a publisher in 1968(9?) while he was working for the publishing company. He remembered reference being made to it at a conference he attended two years ago, but it did not assume significance for him until he was approached by the LEA to become a trial school.

The process and factors that led to the decision to shelve SCISP but to develop a common course for Year 3 based on Secondary Science:

(i) The grant and trial school role were attractive.

(ii) All three heads of departments visited a SCISP trial school in Bristol.

(iii) SCISP materials were sought but the publication of many of these was delayed until late summer. However, the staff appeared to be very familiar with the principles of the scheme and were attracted to it as a course. A junior in the department attended a 3-day course in London.

(iv) Information on 13+ entries to the school was likely to be minimal. The language department had succeeded in getting the 13+ cohort "banded" according to language ability, hence a relevant "science elite" for SCISP was not available and modifications to the material would be necessary and, for this, availability of materials was essential. (Had they remained a grammar school they would probably have gone ahead with a trial of the scheme.)

(v) Secondary Science was seen as more flexible material than SCISP to be adapted across the ability range, with extra material fed into it from the O-level courses.

(vi) A decision was made to develop three Secondary Science themes: initially 3 - Biology of man, 4 - Harnessing energy and 7 - Materials, (but later 3 was replaced by 6 - Extension of sense perceptions). Three members of staff were delegated to prepare materials and order equipment, if necessary. The junior who had attended the SCISP course was appointed co-ordinator. The reports of the meetings held to organize the course showed detailed and thorough planning.

The operation was seen to have been a rewarding exercise, in that the members of the department had come together for the first time to discuss science teaching. The need to reassess the course at the end of each term when the topic changed, but teacher and class remained together, would provide for further interaction. All the staff involved were prepared to cope with all three themes.

The important factors in this situation appeared to be:

a head of science open to change and in touch with developments in science education;

a change in structure with changing pupil-needs that enabled the head of science to extend his leadership;

the availability of funds;

an AEO with science orientation - (these last two may not operate after local government reorganization).

## (v) Report of communication schedule responses

The communication schedule[1] was used in interviewing teachers whenever time permitted, and particularly with senior teachers.

Teachers interviewed with communication schedule.

| LEA | Total | Heads of Science[2] | Biologists | | Chemists | | Physicists | |
|---|---|---|---|---|---|---|---|---|
| | | | head of dept. | assist. | head of dept. | assist. | head of dept. | assist. |
| A | 20 | 9 | 5 | 2 | 6 | 1 | 6 | 0 |
| B | 24 | 7 | 3 | 4 | 3 | 4 | 6 | 4 |
| C | 11 | 6 | 4 | 2 | 2 | 0 | 2 | 1 |
| D | 7 | 3 | 0 | 0 | 1 | 3 | 3 | 0 |

It was not possible under the conditions of the visits to ensure that the schedules were used equally with teachers of all three disciplines. It happened that in LEAs (A) and (B), with the larger number of teachers interviewed, that the distribution across biology, chemistry and physics was fairly uniform, but in LEA (C) biologists outnumbered the total for chemistry and physics, while in LEA (D) no communication responses were obtained for biologists. A possible contributory factor here was that no biologist was a head of science in the schools visited in LEA (D) whereas three biologists were heads of science in LEA (C) schools.[3]

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1. See Appendix S. 1.F. (p. S.03)
2. These also occur in a head of department category.
3. See analysis at the beginning of these reports (p. S.06 and S.07)

## A. L.E.A. (A) Communication schedule responses

### Teaching Practice

All of the schools visited accepted students for teaching practice in science subjects. In nine of the schools these had come mainly from the University School of Education, for which fourteen of the teachers acted as co-tutors. This arrangement involved teachers in one or two formal meetings each year at the University, biology, chemistry and physics groups meeting separately. In addition, some co-tutors, lecturers and students, in grouped schools, had met during the practice period to discuss issues and common problems. This again was organized within separate science subject areas.

Some schools received students from Colleges of Education or other University Departments, but the personal contacts arising from these appeared to depend solely on the tutors' visits to the schools.

### Examining

In general the schools used Mode 3 examining for CSE. For the separate sciences this had been organized for some years in two groups, one in the north of the county and one in the south. More recently a small number of schools had developed a common Environmental Science course. In most cases the heads of department were involved with the separate science CSE examining, while more junior department members were associated with the integrated science work (an exception being one of the nine interviewed heads of science).

Two of the heads of biology were involved in GCE O-level examining, one acted as a moderator for A-level, while another had been involved with A-level revision.

### Membership of professional bodies

All but four of the teachers interviewed were members of the ASE, though only one mentioned making a point of attending the annual conferences and only two mentioned attending any local meetings during the last year. One teacher described the Association as "not active in the area", another had given up membership because it was "no longer as relevant" to a comprehensive school as to a grammar school.

Two of the biologists were members of the Institute of Biology and one chemist of the Chemical Society. Half of the upper school teachers interviewed were associated with local teacher groups in biology, chemistry and physics.

The physics group was of long standing in the area and a physicist tutor at the School of Education was closely associated with it. With the co-operation of the local science advisers he had organized, for some years, a three-day think-in for physics teachers at the end of the summer term, when student teachers were used to replace teachers in the schools. This organization had later spread to the biology and chemistry teachers.

An RIC Chemistry Teachers' Centre was established at the University, a tutor at the School of Education acting as secretary, and a Biology Teachers' Centre had been developed by a local teacher who had moved to the School of Education.

## Meetings and courses

For some of these senior teachers in the large upper schools there was a heavy commitment to after school meetings in connection with the running of the school. For one this was reportedly 30 to 40 meetings of the Academic Board in the year, (however, to a colleague attending the same meetings they had taken place 20 or 30 times). For another, membership of two committees meeting fortnightly, resulted in a regular weekly evening commitment throughout the year. For others a meeting once in two weeks, or once a month, was more common.

The pyramidal structure of secondary education, with high schools "feeding" into upper schools, required some kind of organizational contact. This appeared to vary from one to six meetings in a year and usually separately for the three sciences.

Most upper school teachers had attended between one to seven single evening meetings at various institutions, the most frequently reported being run by the University Teachers' Centre or the School of Education. An LEA Teachers' Centre was mentioned by the high school teachers only, who referred, with approval, to a high school "teach-in" organized by the Science Adviser. Apart from this one event, only the meetings with the linked upper schools appeared to have relevance for the high schools. However, one head of science in a high school had apparently become the county A.V.A. expert and co-ordinated a group of teachers who viewed and reported on (in a regular bulletin) new films, loops, etc. This involved them in nine or ten meetings in a year.

Most of the teachers had attended some kind of extended course in the last three years; three had attended two and one had taken part in three courses. These had frequently been held locally (at the School of Education) on one evening a week over a period of time (usually a term), but some were short vacation courses or had been held at the end of the summer term. For six teachers the course was based on the Nuffield A-level project in their appropriate science, four had attended a Nuffield Secondary Science course, and three biologists had attended vacation field studies courses. One young teacher was following the Open University Foundation Course in Science, another had completed one year of an M.Ed. course, while an older teacher had taken part in a two-stage vacation course at a university "to get a taste of the academic life".

## Contacts for advice

In large schools employing more than one teacher in each of the specialist sciences, it is not surprising that teachers reported first consulting their colleagues if they wanted to discuss work in their own or other subject area in science. Many went on to mention by name lecturers on the university staff, or in a more general way "other upper school teachers" - contacts made through the various formal organizations discussed earlier. A few senior teachers were known for their expertise in a particular field (e.g. in AVA or as a naturalist) but, in general, appeals for advice were perceived to come from within their own school community.

For apparatus and equipment they would usually get in touch with the Science Adviser, (who assumed a more general advisory role for the high schools, with their fewer formal contacts) or a manufacturer's representative.

## Organizational factors

For most teachers comprehensive reorganization was a welcome, accepted fact, but attitudes to the raising of the school leaving age were more cautious. One high school regretted the loss of the more mature pupils (the early leavers), while some upper schools had not satisfactorily solved the problem of science for the less able pupils. LEA boundary reorganization did not appear relevant to the science teachers.

Teachers were questioned about the integration of the science department, internally and within the school. In only two schools (one without an overall head of science) was there said to be no recognizable science department, but only three separate subjects. (In one of these schools physics was in a separate building and in the other biology was separate.) Three other schools reported science to be a unit, with much interaction, but somewhat isolated from the rest of the school, while others recognized a department staff that was "fairly integrated" into the rest of the teaching staff. A future development plan for more than one school was for physics to join design and engineering in a separate new block. Teachers anticipated that this would make intra-science communications (and integrated science courses) more difficult.

A few science departments held regular formal meetings of staff - once a week or once a month. This was often, but not always, associated with a hierarchic structure of faculty meetings feeding to academic boards. In other schools the frequent, casual contacts between persons provided discussion opportunities and no formal departmental meetings were arranged.

## Other Commitments

The teachers were asked about other time-consuming, regular commitments, the intention being to explore any differences this might reveal between men and women teachers. In this LEA, however, there were few women heads of departments - only one out of a possible twenty-eight in the schools visited. The communications schedule was used with two women assistant teachers. One of these was unmarried, in her third year of teaching, and had developed a variety of personal communication channels. The other had two children at school and reported that she was prevented from attending meetings as she had no transport of her own.

A high proportion of the men were married and some had young families, but none reported that this involved them in regular time commitments. Many, however, were heavily committed to "extra-curricular" activities in school, some with games, science clubs, film clubs, folk clubs, sailing clubs and a fifth of them with some kind of musical activity. Several were deeply involved with community or youth work, sometimes within a local church. One busy head of department produced one or two operas a year in the school, travelled abroad with the orchestra and acted as a church organist. Few mentioned regular commitment to personal recreation.

There was indication in only one case that the other commitments undertaken by these men teachers inhibited their familiarity and involvement with curriculum development. Indeed, in general, the association appeared to operate positively - those teachers who were active in other spheres were also those actively engaged in curriculum development.

## Other contacts

When asked to name the occupation of the three people they spent most time talking with out of school, half of the teachers interviewed mentioned other teachers. Others named a variety of professions among neighbours or their own local community or church. Several had married erstwhile teachers.

## Career

Few of the teachers mentioned any desire to be working outside education; one had left industry for teaching some years before. Several anticipated a move from science teaching to a more administrative or pastoral role within the school system (indeed there was evidence that this had already happened with erstwhile heads of science departments in at least two of the schools visited); only one teacher firmly ruled out administration.

## Local Institutions: Courses and meetings for science teachers

### L.E.A. (A)

### School of Education[1]

| | | | |
|---|---|---|---|
| 1966 | Summer term | 10 evening meetings | Nuffield O-level Physics |
| | | one week | Nuffield O-level Chemistry |
| | Autumn term | 10 evening meetings | Nuffield O-level Physics |
| 1967 | Spring term | 9 evening meetings | Nuffield Secondary Science (pre publication) |
| | | 1 evening meeting | Nuffield A-level Physics (very early development stage) |
| 1968 | Summer term | 8 evening meetings | Nuffield Biology, Years 1-2 |
| 1969 | Spring term | 10 evening meetings | Nuffield Biology, Years 3 and 4 |
| | Autumn term | 10 evening meetings | Nuffield Biology, Year 5 |
| | | 1 evening meeting | Nuffield A-level Physics (pre publication) |
| 1971 | Autumn term | 10 evening meetings | Nuffield Biology, Years 1-3 |
| 1972 | Autumn/Spring terms | 15 evening meetings | Nuffield A-level Physics |

### University Biology Teachers' Centre

| | |
|---|---|
| 1970 (year of formation) | 2 practical workshops |
| 1970/71 | 4 practical workshops |
| 1971/72 | 1 lecture, 1 workshop |
| 1972/73 | 1 weekend course (cancelled for lack of response)<br>3 lecture sessions |

Most workshops and lectures dealt with advanced biology topics. The secretary for the Centre had originally been a tutor from the School of Education, but was later a head of science in a local school.

The attendance at meetings was usually between 10 and 20 persons, but occasionally fell below 10 and rarely exceeded 20.

The secretary reported that several methods had been tried to notify teachers of the Centre's activities, the most effective being to send information by first class post, direct to schools, and addressed to "The Biology Staff".

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[1] This information was extracted from separate notices advertising the courses. These were provided by the School of Education in response to a request for information about courses based on Nuffield Curriculum Development Project materials. There is no certainty that it represents all courses in science that had been held.

No detailed records had been kept by the Physics Centre, but the organizing tutor reported that from 1966 to 1971 there had been single evening or Saturday morning meetings - between one and three of these in any year - on the following topics -

1. Discussion transfer 6th form - university in Physics
2. Visits to research groups in the department
3. Discussions on teaching a topic at 6th form/1st year university level.

There had also been two 1 term/1 evening a week courses on electronics. Since 1972 there had been similar sorts of activities through the local Centre for Physics.

No information was available about the Chemistry Centre programme.

## B. L.E.A. (B) Communication schedule responses

### Teaching practice

All of the schools visited accepted students for teaching practice in science subjects. For the grammar school these came from the Institute of Education in one of the Universities bordering the county. In all the other schools the students came from both Colleges of Education and University Institute or School of Education. None of these training institutions operated a co-tutor scheme; any contacts associated with teacher training (apart from with the students) occurred when tutors visited schools. These visits were "usually rushed" and in only three schools had there developed any discussion of science education in general (in one of these the head of science "made a point of talking to them"). Seven of the assistant teachers had had no contact with tutors.

### Examining

Only one of the twelve assistant teachers was involved in examining - a Mode 3 (single school) - although another was anticipating the development of a single school Mode 3 based on the Nuffield Secondary Science materials. Seven heads of department were involved with CSE work in some way, on subject panels, or general discussion groups incurring them in from 1 or 2 to 6 or 8 meetings in the year. One of these heads of science (a recent arrival in the county) examined for O and A level physics and A-level physical science (10 meetings in the year), while another examined O-level biology.

### Membership of professional bodies

Only eleven of the twenty-four teachers interviewed belonged to the ASE, (several non-members reported that "no-one had suggested I should join"). Only two teachers mentioned attending meetings organized by the local ASE branch during the year. More than half, however, reported their membership of one of the University Teachers' Centres and all of the schools sent a committee member to the newly formed county Science Teachers' Association. Most teachers regarded themselves as members of this Association. One teacher was a member of the Chemistry Society.

There were separate Biology, Chemistry and Physics Centres associated with one university. At the other, work with teachers was organized through "workshops" in a "Curriculum Development Centre".

### Meetings and courses

Only one of these teachers reported a heavy commitment to internal school evening meetings (24) and he was a deputy headmaster with counselling responsibilities in a small school. Another mentioned 12 meetings and two others 5 evenings set aside for parents' meetings in the spring term.

Seven teachers (all assistants, except for the man referred to above) had attended no evening or weekend meetings in science in the last twelve months and four of these had attended no extended courses in the last three years (three were teachers in their probationary year, however).

Eight teachers had attended from 1 to 4 meetings organized by the county Association (one of which was a residential week-end on Combined

Science), while thirteen reported attendance at one or more meetings at a University Teachers' Centre.

Seventeen of those interviewed had attended at least one extended course in the last three years: two had attended 3, and three had attended 2 courses. For three teachers these courses were in careers guidance or counselling, which were further responsibilities assumed by them in the schools. Only five teachers mentioned extended courses for Nuffield projects: 2 at A-level, 2 Secondary Science and 1 Combined Science. For others the courses were in marine biology, low temperature physics, geology, radio chemistry, sixth form science, etc.

## Contacts for advice

Thirteen of the teachers mentioned only their own colleagues as sources of advice on subject matter, materials and equipment and organizational problems. Four mentioned, in a general way, teachers from other schools, two referring to the county Association. Only four referred to particular persons outside the schools (two of these were from the girls' grammar school). One teacher who had been involved in Nuffield trials elsewhere reported that if problems arose with curriculum development project materials he would approach the organizers of the project. There was no Science Adviser appointment in the LEA; each of the Inspectors of Schools was mentioned once as a useful contact. One with a mathematics background was said to have been very active within the Curriculum Development Centre workshops two years earlier and a probationary teacher reported that this inspector had drawn his attention to SCISP, when visiting him in the school. One head of science reported his department as an authority on mixed ability teaching and another as approached for advice on individualized learning.

## Organizational factors

There was a general reservation about compelling the few reluctant pupils to stay at school until 16, but most teachers interviewed found comprehensive reorganization acceptable or welcome (for most schools this would involve the inclusion of only a few more of the top ability pupils). Most teachers, too, were apprehensive about the effects of local authority reorganization which would result in the disappearance of the county authority and parts of it joining three new LEA areas, together with parts of other existing LEAs practising different school organizations. The teachers saw their county authority as relatively progressive and generous and feared the change.

In only two schools was the science department seen as a separate unit, although in another it was noted that the move of science to a new block had made it less possible for the staff to be integrated into the rest of the school. In one school mathematics, science and craft formed a "progressive" group in conflict with more "traditional" teachers.

No school reported the holding of formal meetings of science teachers, but in two "tea-break" was taken in the department and in one of these this was regarded as a regular department meeting. Teachers in this school reported endless and varied discussion with science colleagues, but little with other staff; they denied, however, that this resulted in their being less well integrated than other departments into the school.

## Other commitments

Six teachers mentioned giving extra time to school games activities, three to helping with music and seven ran some kind of science club.

Several were associated with youth work in the community, six with church groups.

Two teachers were following Open University courses and one was working for an M.Ed (part time).

A few played golf, badminton or hockey for their own recreation, others belonged to orchestras, painted or gardened.

Only one reported a regularly timed commitment involving his family, although several mentioned sharing the responsibility of bringing up children. The only married woman interviewed was about to leave teaching for the birth of her first child.

## Other contacts

The wives of nine of the men teachers were currently teaching in schools, two were nursing and two were doing some kind of social work.

A third of the teachers talked frequently with other teachers out of school, but a variety of occupations were mentioned, many involving people with common interests in natural history, church work or golf etc.

## Career

Few of the teachers interviewed appeared to wish to be working in another field than education. Indeed, a few almost resented being asked what change they anticipated making - "why should I change, I like my job?". The alternatives suggested fell into two groups - academic or research work and some kind of social or pastoral work.

Some tentatively mentioned a deputy headship, or some kind of administrative position as a career objective. Three considered a college of education post, but for more experienced teachers salaries were not advantageous.

## Local Institutions: Courses and meetings for science teachers

### L.E.A. (B)[1]

### Chemistry Teachers' Centre[2]

An RIC Summer School was held in one of the local universities in 1965. The advantages accruing from the personal contacts made on this occasion led to the formation of a local group in the autumn of the same year.

An early report from the secretary gave the average number of meetings as four a year, and a programme covering a wide range of topics.

### Recent programme

1969/70 5 meetings:
- Apparatus and audio-visual aids - exhibition and discussion
- Meeting with local industrial chemists
- Chemistry books for the less able pupil
- SI units - lecture and discussion
- Reaction kinetics

Also 10 meetings at the College of Technology and
15 film appraisal sessions at the university.

1970/71 A year devoted to the study of the new London A-level syllabus

1971/72 7 meetings:
- 2 general topics
- 1 laboratory kits
- 1 visit to university laboratories
- 1 on text books
- 1 on A-level examination questions and answers
- 1 historical topic

1972/73 4 meetings:
- 1 historical topic
- 1 glass-blowing demonstration
- 1 advanced topic
- 1 talk from city analyst
- also, appraisal of Open University films

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[1] When enquiries about courses for science teachers were made at the Institute of Education of one university in the area, the researcher was referred to the Teachers' Centres in Biology, Chemistry and Physics.

[2] From information provided by the secretary of the Centre.

The activities of the Centre were publicized in a folded "Joint Programme" card referring to the following organisations:

the local section of the Chemical Society,
the local section of the R.I.C.
the University Student Chemical Society,
the Chemistry Teachers' Centre,
the A.S.E.

Of recent years these cards gave information about some 27-30 meetings. They were sent to all members of the organizations mentioned.

## The Physics Centre[1]

This Centre was founded in 1970. It is interesting that an early report links its origin with the similar Physics Centres (N.B. not Physics Teachers' Centres) in other universities, and not with the Chemistry Teachers' Centre that had existed for five years within its own institution. However, it was stated that the intention was to collaborate with the Chemistry Centre and with the local A.S.E. branch.

The Centre held a regular 9 or 10 meetings in the year. Almost all of them were directed towards recent work developing in physics or modern applied physics. Members were also notified of meetings held by the local branch of the Institute of Physics.

The secretary reported a membership of 100+ and an average attendance at meetings of 30 persons.

## The Biology Teachers' Centre[1]

This Centre was founded in 1971, following a suggestion made in 1970, from a local teacher to the Dean of Science at the university. The number of meetings per year had increased from 3 to 9, and members were invited to other seminars and lectures held within the separate departments of "Biology".

The topics of lectures show that the Centre used the expertise of the university departments, but recently more meetings were being centred in schools. There has been a proposal that the Centre should co-ordinate an "organism bank" for schools. Towards the end of 1973 a joint meeting of all three Centres was to be held to discuss SCISP[2]. (This was some nine months after the interview visits to the area had taken place.)

The activities of the Centre were publicized in a News-sheet published, at first, monthly but, more recently, three times a year. Posters have also been prepared for display.

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1. From information supplied by the secretary of the Centre.

2. Schools Council Integrated Science Project.

## C. L.E.A. (C) Communication schedule responses

### Teaching practice

Of the schools visited the comprehensive schools were used by both the local University and College of Education for student school practice, while the grammar schools were used only by the University. There seemed to be a move afoot to establish some kind of regular meeting of tutors, teachers and students in connection with teaching practice: one school reporting that the school had requested this, another that students had suggested the meetings.

The tutors' visits to the schools did not often provide opportunity to discuss general aspects of science education; "it depends on the tutor", "I make a point of talking" and "you have to make time".

### Examining

Only three of the teachers interviewed had no commitments to meetings involving examining, three had infrequent meetings of a CSE panel (2 to 3 meetings a year). Two others were members of more than one panel, one teacher was involved with a biology syllabus revision for the College of Education, one with Common Examining at 16+ (about 10 meetings in the past year) and another was a Chief Examiner for General Science for one Examining Board and examined at O and A level Chemistry (about 20 meetings in the year).

Of these contacts only the CSE examining brought local teachers together to any great extent.

### Membership of professional societies

Just over half of the teachers belonged to the ASE . (It was reported that the local branch had recently acquired a new committee.)

All but three of the teachers referred to membership of the appropriate specialist Science Teachers' Centre, based at the University. Two teachers were LEA representatives on CLEAPSE.[1]

At the time of the interviews it had been decided to form a federation between the local ASE branch and the three subject teachers centres at the University to avoid date clashes for meetings and excessive demands on teachers, but also to encourage joint meetings between existing centres "to reflect the increasingly inter-disciplinary nature of science at both the school and the University level". It had been agreed that the programme relating to work at O-level and below would largely be the responsibility of the ASE, while post O-level meetings - for teachers and sixth-formers - would be provided in the Teachers' Centres.

A Science Newsletter was produced at the beginning of each school year by a tutor in the University School of Education and sent to local schools. It contained information about short courses in science to be held during the year at a variety of centres accessible to local teachers, new examination syllabuses and text books, new science degree courses, new curriculum development projects and addresses of useful associations.

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[1] Consortium of Local Education Authorities

## Meetings and courses

Eight of the eleven teachers interviewed had attended between one to six evening meetings at the University, most of them organized within the Biology, Chemistry or Physics Teachers' Centres.[1] Some had attended a two-day vacation course on Combined Science, run in connection with the Curriculum Development Centre and held at the new comprehensive school. Two teachers from one school had visited a SCISP trial school in Bristol.[2]

All of the teachers had taken some kind of extended course in the last three years: five had attended a series of evenings at the School of Education the year before, at which the Nuffield Science Project materials were presented and discussed, two had attended courses on a Nuffield A-level project, one on Secondary Science and two on SCISP.

One teacher was involved in work for a part-time B.Ed. course at the local College of Education, another was following an Open University Post Experience Course.

One very experienced teacher was an active committee man in the AMA, which involved him in numerous national meetings and councils, including sub-committees of the Schools Council. He was also the man with heavy examining commitments. He was confident and assured in the status he had achieved - his chemistry syllabus was highly traditional in its format and content and included a statement of limited time allowed for class practical in each year of the course.[3]

## Contacts for advice

The School of Education and University staff were well known to quite a few of the teachers, and several were mentioned by name as useful contacts - (this was particularly so in the case of the biology tutor who edited the Science News Letter [4]).

The technical college had been a useful source for the loan of apparatus. The Museum Service made slides, films and specimens available. The husbands of three of the married women teachers were involved with local science research establishments and these proved useful contacts. The part-time teacher, who was acting head of science in one of the girls' schools was mentioned as helpful in two other schools.

The Curriculum Development Centre was a potential useful resource - (the Warden, prompted by the local Science HMI, had organized the course for Combined Science, and one teacher had borrowed Nuffield project materials from him).

The Science HMI was highly visible to the teachers in the area, following an inspection of school science - several teachers spoke appreciatively of his help.

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1. The secretary of one of the Centres reported that attendance was made up mainly of teachers from direct grant and independent schools.
2. Two schools were about to become SCISP trial schools: there were plans to keep these in touch with each other and with two other similar schools in the new enlarged LEA. The future Science Adviser was to be the common link.
3. He was charmingly tolerant of the activities of curriculum developers and a courteous host to the interviewer!
4. More biologists than chemists and physicists were interviewed.

## Organizational factors

The extension of compulsory education to 16+ was regarded with mixed feelings in the bilateral schools. Comprehensive reorganization had not involved extensive changes in any school (the grammar schools were still unaffected). It was possible that paired boys and girls school might offer common sixth form courses. Boundary changes had not become an important issue.

In three schools the science department was seen as rather separate from the rest of the school. In two of these "tea break" was taken as a department (which was extended to embrace other non-smokers, including the two deputy heads, in one of them).

One department had a formal meeting once a month, but in another school the headmaster had time-tabled a period (extended the following year) for all science staff to meet together.

## Other commitments

All three women interviewed had extensive home commitments. One had two children at primary school and the other two had heavy entertaining programmes in connection with their husbands' work. All three participated at a relatively high level in communication activities.

Two men taught evening classes and two were active church members, but none mentioned youth work or community work, except for one woman who was a manager of a primary school.

## Other contacts

One older man claimed that he made a point of avoiding other teachers out of school. Two of the men were married to practising teachers and three mentioned talking with teachers. Other contacts showed a variety of occupations, mostly professional or technical.

## Career

Only two of the men interviewed had career patterns in mind. These followed the conventional move to College of Education or administrative work in the school (but not head teacher). Other men appeared content with their existing jobs. It was apparent that the women did not think in career terms, although one had held a high level post in research before marriage. The woman head of science commented that her "career had been thrust upon her".

## Local Institutions: Courses and meetings for science teachers

### L.E.A. (C)

School of Education Programme[1]

| | | | |
|---|---|---|---|
| 1966 | Summer term | 5 days | Nuffield O-level Physics and Biology (invitation only) |
| | Autumn term | 5 days | Nuffield O-level Chemistry |
| | | 5 days | Nuffield O-level Biology |
| | | 6 evenings | Science and Engineering |
| 1967 | Summer term | 4 days | Physics in Sixth Form |
| | | 3 weekends | Laboratory techniques in secondary school science |
| | Autumn term | 6 evenings | Science and Engineering |
| | | 1 weekend | Chemistry of Living Things |
| 1968 | Spring term | 3 weekends | Laboratory techniques in secondary school science II |
| | Summer term | 4 days | Biology in Sixth Form |
| 1969 | (The programme sheet for Spring 1969 was missing) | | |
| | Summer term | 4 days[2] | Nuffield O-level Physics |
| | Autumn term | 4 days[2] | Nuffield O-level Chemistry |
| | | 4 days[2] | Nuffield O-level Biology |
| 1970 | (Programme sheets for Spring and Summer 1970 were missing) | | |
| | Autumn term | Vacation course | Nuffield A-level Biology |
| 1971 | Spring term | Vacation course | Nuffield A-level Chemistry |
| | | 8 evenings | Science 11-13 (Nuffield Combined Science) |
| | Summer term | 1 evening | Nuffield A-level Biology |
| | | 1 weekend | Conservation and School Curriculum |
| | | Vacation course | Sixth Form Studies in Biology |
| | Autumn term | 8 evenings[3] | Nuffield Secondary Science |

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1. Taken from programme sheets provided by the School of Education.

2. Held at the local College of Education

3. Held in a school in the County Authority

| | | | |
|---|---|---|---|
| 1972 | Spring term | 3 evenings | Nuffield A-level Biology |
| | | 8 evenings | Planning the Secondary School Science Curriculum |
| | | Weekend | New Look at Public Examinations in Chemistry |
| | Autumn term | 4 days | Nuffield A-level Physics |
| | | Weekly 2 terms | Technology in Schools |
| 1973 | Spring term | Weekend | Project work in Nuffield A-level Biology |
| | | Weekend | Maths for Biology teachers |

### Area Chemistry Teachers' Centre

This had been set up in 1969 but no detailed information about its programme was available.

### Area Physics Centre

A Physics Centre, associated with the University Physics Department, was set up at the end of 1970.

#### Programme

| | |
|---|---|
| 1970/71 | 7 meetings |
| 1971/72 | 11 meetings |
| 1972/3 | 12 meetings |

These meetings covered a wide range of topics in recent developments in physics and astronomy, presented by university staff, but also some topics presented by school teachers, visits to school and university laboratories, a discussion of Nuffield A-level Physics, the writing of objective test items, viewing of films, etc.

In addition, Easter vacation refresher courses had been held. Accommodation was offered for these, but very few required it. (13 teachers)

| | |
|---|---|
| 1971 | Solid State Physics |
| 1972 | Physical Properties of Materials |
| 1973 | The course had to be abandoned as Easter vacation dates proved to be too variable. |

The secretary reported a mailing membership of 130, with attendance at meetings of between 20 and 90 (a recent average of 35). He further reported:" Regular members tended to be physics specialists from schools with strong, well-established science departments and members of University staff...... the Centre does not yet appear to be of significant service to the ordinary physics teacher in the ordinary secondary school."

### Area Biology Centre

An inaugural meeting of this Centre was held in November 1971 - a further programme of meetings was arranged.

| | |
|---|---|
| 1972 | 4 meetings |
| 1972/73 | 8 meetings |

These meetings ranged from "Middle School Ecology" through "practical sessions" relevant to different stages of school work, to advanced topics in Biology.

Attendance was usually between 20 and 30 persons, but had been below 10 for two meetings (one being a book exhibition in November and the other a lecture demonstration session in June).

A termly News-sheet gave details of activities and provided a tear-off strip to be returned by those interested in attending the meetings advertised, (in one News-sheet the secretary pointed out how inaccurately the returns reflected attendance). Reference was made each term to other activities of potential interest to Biology teachers, including events organized by the School of Education, and to other resources available in the area.

As reported[1], the three Teachers' Centres had recently formed a Federation with the local branch of the A.S.E.

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[1] See L.E.A. (C) - Communication Schedule Responses.

## D. L.E.A. (D) Communication schedule responses

### Teaching practice

The science department in the small ex-secondary modern school had not been used for teaching practice; the other ex-modern school had been used by a College of Education. The ex-grammar schools had been used by the University. No teacher reported discussion arising from the tutors' visits but one stated that the year before the School of Education had called a meeting of science teachers; no other teacher reported attendance at this meeting.

### Examining

Three teachers referred to the value of the Science Consortium for CSE established within the LEA. Two teachers were members of their appropriate subject panel. The headmaster of one ex-modern school had been chairman of the CSE Board's Science Panel for some years. Three teachers were not involved with examining.

### Membership of professional associations

All but one teacher reported membership of the ASE and of the Science Centre[1] established within the University. One teacher was a member of the Chemistry Society.

### Meetings and courses

The ASE local branch was said to be "active" and three teachers reported attending meetings regularly. The workshop evenings, and meetings on Nuffield Secondary Science, at the Science Centre, had been attended by one teacher each. One young man reported that the rest of the department was not involved in the Science Centre activities. A head of chemistry "had not attended a local meeting in two years", but had taken part in RIC activities.

The two women teachers at the girls' ex-grammar school had attended a large number of meetings and three extended courses each, one of which was on the appropriate Nuffield A-level course. One teacher had attended a SCISP course and another had just returned from a full-time one-year M.Ed. course.

One head of science in an ex-modern school had no car and found evening meetings difficult to attend. He was anxious to find a vacation short course in middle school science (the school was developing into a 9-13 school), but none was available anywhere in the country.

The problems associated with the sudden influx of several classes of 13+ pupils from modern schools had involved the teachers in the new upper schools in a considerable number of internal meetings.

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[1] This has replaced the existing Chemistry and Physics Centres, at the Polytechnic and the University respectively, at the time when a Biology Centre was proposed. (See Appendix S. )

Contacts for advice

There appeared to have been different communication contacts for grammar school and secondary modern schools. The grammar schools had found the University departments, the ASE and professional societies useful. The modern schools contacts were found within the CSE Consortium and an informal group of heads of science - all physicists who had met to discuss common problems and had invited guest speakers to their meetings. This was no longer functioning - its chief convener had retired and other schools were changing status.

The full-time tutor appointed to the Science Centre (some said he was the Science Centre) was a new factor in the situation - one teacher said "if you haven't been to the Centre for some time he'll come and find out why not". Several schools were finding his apparatus repair service very useful.

In the absence of a Science Adviser one teacher had turned to the Adviser in an adjacent LEA for help.

School factors

The staff in two of the schools visited were distressed by the changes accompanying the reorganization of schools. In one this had involved the merging of a single sex and a mixed school as well as a change in pupil age-range. Several complained about the absence of back-up resources. It appeared that the coinciding of reorganization with the raising of the school leaving age created problems for the schools.

One school had found that its meetings to plan what to do with Year 3 had integrated the separate science departments and they had been glad of this side-effect. A young teacher in the "amalgamated" school wished they had department meetings - here the science staff were split between two buildings and one part joined colleagues in a few other craft subjects in a separate "tea break". In the girls' school the head of science had refused the offer of a staffroom in the new science block as she foresaw unwelcome outcomes in the isolation of science teachers from the rest of the staff.

Other commitments

Few teachers reported heavy out-of-school commitments - one ran a Science Club (separate nights for boys and for girls) and taught an Evening class; another ran a Guide company and played in an orchestra.

Other contacts

These were with teachers or professional people.

Career

Two teachers had made recent changes - one from a public school and he was happy to be back with "working class kids", the other saw no further step from the head of Middle School science that he had become. The two women were uncertain - one had intended to work with handicapped children, but had become a head of science, almost, it seems, against her will; the other had come into teaching via a Grad. RIC, was married and was considering the next move.

A probationary teacher was disturbed at the conflict he experienced between the advice he had been given "to move on after 2 years" and the need to stay to "see things through".

## Local Institutions: Courses and meetings for science teachers

### L.E.A. (D)

### University Delagacy for Educational Studies[1]

| | | | |
|---|---|---|---|
| 1969 | Spring term | ½ day | Project Technology |
| 1969/70 | Autumn term | 10 evenings | Microbiology |
| | | evenings | Laser and micro wave sources for schools |
| | | evenings | Computer application for Chemists |
| | | evenings | Modern electronic devices for schools |
| | Spring term | 10 evenings | Nuffield O-level Biology |
| | | 5 days[2] | Radio isotopes |
| | | 5 days | Science and Mathematics in secondary schools |
| 1970/71 | Autumn | 5 days[2] | Radio isotopes |
| | | 5 days[2] | Radio isotopes: Applications of Science and Technology |
| | Spring | 5 evenings | Nuffield A-level Physical Science |
| | | 5 days[2] | Radio isotopes in schools |
| | | 5 days[2] | Radio isotopes: Applications of Science and Technology |

### University Centre for School Science and Technology

A Physics Centre, established in the university by the Institute of Physics in 1969, and a Chemistry Teachers' Centre established by the Royal Institute of Chemistry in 1970, had been replaced by the Schools Science and Technology Centre in 1973. "The Centre has developed from the work of the Schools Council Project Technology, from the Standing Conference for Schools Science and Technology, from the School Technology Forum, and from the separate specialist subject centres. ..... It has grown with encouragement from the Association for Science Education, with help from the Local Education Authorities, the University and the Polytechnic, and with good will from local industry"[3]

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1. Extracted from R. J. Vivash 1971 "A Survey of Resources Available to Science Teachers in Secondary Schools", unpublished M.Ed. Dissertation, Chelsea College, London.
2. Held at the local research centre.
3. From the first Newsletter from the Centre.

**Programme**

| | | |
|---|---|---|
| 1973 | June | Resources for the future. (organized jointly by LEA advisory staff and the Centre) |
| | September | Work cards and work sheets. (organized by the Chemistry Panel) |

The Newsletter advertised all other meetings and courses relevant to science teachers in the area. All head teachers had been notified of the formation and purpose of the Centre and the Newsletter sent to all science departments in all local schools.

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